

DEVELOPMENT OF A LEGAL INFORMATION QUESTION ANSWERING SYSTEM USING OPENAI, RAG, AND LANGCHAIN TECHNOLOGY



Written by:

N a m e : Saarah Muthiah Yasmin

Student Number : 21523252

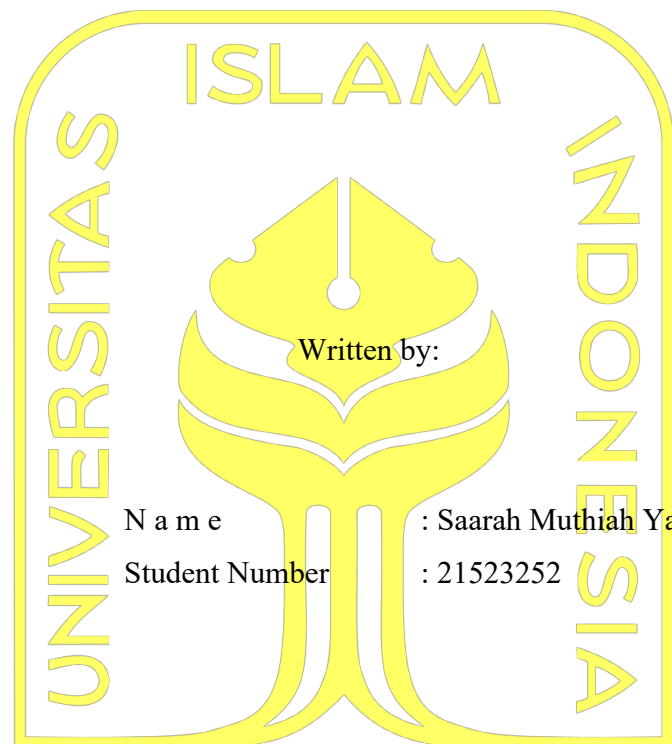
**UNDERGRADUATE PROGRAM IN INFORMATICS
FACULTY OF INDUSTRIAL TECHNOLOGY
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SUPERVISOR ENDORSEMENT PAGE

**DEVELOPMENT OF A LEGAL INFORMATION QUESTION
ANSWERING SYSTEM USING OPENAI, RAG, AND
LANGCHAIN TECHNOLOGY**

UNDERGRADUATE THESIS



Written by:

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: Saarah Muthiah Yasmin

Student Number

: 21523252



Yogyakarta, July 23rd, 2025

Supervisor,

(Dhomas Hatta Fudholi, S.T., M.Eng., Ph.D.)

EXAMINER ENDORSEMENT PAGE

**DEVELOPMENT OF A LEGAL INFORMATION QUESTION
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UNDERGRADUATE THESIS

Has been defended in front of the examiner as one of the requirements to
obtain a Bachelor of Informatics degree from the Undergraduate Program in Informatics
at the Faculty of Industrial Technology, Universitas Islam Indonesia

Yogyakarta, September 1st, 2025

Chair

Dhomas Hatta Fudholi, S.T., M.Eng.,
Ph.D.

Examiners 1

Dr. Novi Setiani, S.T., M.T.

Examiners 2

Hari Setiaji, S.Kom., M.Eng.

Acknowledged by,

Head of Undergraduate Program in Informatics

Faculty of Industrial Technology

Universitas Islam Indonesia



(Dhomas Hatta Fudholi, S.T., M.Eng., Ph.D.)

AUTHENTICITY STATEMENT

The undersigned:

Name : Saarah Muthiah Yasmin
Student Number : 21523252

Hereby declare that the thesis entitled:

DEVELOPMENT OF A LEGAL INFORMATION QUESTION ANSWERING SYSTEM USING OPENAI, RAG, AND LANGCHAIN TECHNOLOGY

is entirely the result of my own independent work. Should any part of this work be found, now or in the future, to be not the product of my own efforts, I fully accept that this final project may be withdrawn and am prepared to bear any consequences and responsibilities arising therefrom.

This statement is made sincerely and may be used as necessary.

Yogyakarta, July 22nd, 2025



(Saarah Muthiah Yasmin)

DEDICATION PAGE

All praise be to Allah Subhanahu wa Ta'ala. I sincerely dedicate this final project to my incredible support system, who have stood by me with love, time, and endless support. Thank you for every prayer, encouragement, piece of advice, and the unwavering love. I also honor the strength within myself, for enduring and holding on through it all. A heartfelt thank you to my dearest Mommy and Kakak, your presence and support have meant the world to me. May this step forward be the beginning of a lifelong effort to make you proud and bring you happiness.

MOTTO

لَا يُكَلِّفُ اللَّهُ نَفْسًا إِلَّا وُسْعَهَا^٢ لَهَا مَا كَسَبَتْ وَعَلَيْهَا مَا اكْتَسَبَتْ^٣ (٢٨٦...)

“Allah does not require of any soul more than what it can afford. All good will be for its own benefit, and all evil will be to its own loss. ...” The Cow (2:286)

"Be kind to everyone." -Oki Rengga

PREFACE

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With deep gratitude, I would like to express my sincere thanks to Allah Subhanahu wa Ta'ala and to all parties who have supported the completion of this final project report entitled "DEVELOPMENT OF A LEGAL INFORMATION QUESTION ANSWERING SYSTEM USING OPENAI, RAG, AND LANGCHAIN TECHNOLOGY." This final project was written to fulfill one of the requirements for the undergraduate thesis defense at the Department of Informatics, Faculty of Industrial Technology, Universitas Islam Indonesia. I realize that without the support and motivation from many individuals, this report would not have been completed successfully. Therefore, I would like to extend my heartfelt thanks to:

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Wassalamualaikum warrahmatullahi wabarakatuh

Yogyakarta, July 22nd, 2025

A handwritten signature in black ink, appearing to read 'Saarah' in a cursive, flowing script.

(Saarah Muthiah Yasmin)

ABSTRACT

This research aims to develop a QA system based on Retrieval-Augmented Generation (RAG) as a solution to improve public accessibility and understanding of legal information regarding public services. The background for this study is the difficulty often faced by the public in understanding legal procedures and their rights, as well as the limitations of the existing information service system at the Lembaga Ombudsman Daerah Istimewa Yogyakarta (LO DIY).

The literature review in this study covers several main pillars: the profile and function of the Regional Ombudsman Institution of the Special Region of Yogyakarta (LO DIY), the basic concepts of chatbot technology, Generative AI, and Large Language Models (LLM). The main focus is on the Retrieval-Augmented Generation (RAG) architecture, which combines external information retrieval capabilities with text generation to enhance the accuracy and relevance of answers. A review of previous research indicates the successful implementation of RAG in various domains. Based on the literature study, four main indicators were established for chatbot evaluation: Perceived Usefulness, Accuracy, Relevance, and Clarity.

This research methodology is systematically structured through four main stages: requirements analysis, design, implementation, and evaluation. The requirements analysis stage was conducted through interviews with experts from LO DIY and the collection of relevant legal documents. The design stage included the creation of use case diagrams, activity diagrams, and an intuitive user interface design. The implementation stage involved developing the system using the LangChain framework, the GPT-4 model, and the Chroma vector database to apply the RAG architecture. The evaluation stage was conducted by involving five legal experts from LO DIY to compare the responses of the RAG chatbot with a non-RAG one and to fill out a questionnaire based on the established indicators.

The research results show that the chatbot developed with the RAG architecture is significantly superior to the non-RAG chatbot. The evaluation by experts confirmed these findings with very positive scores, with the average for Perceived Usefulness (12), Relevance (8), and Clarity (8.4) indicators falling into the "High" category, and Accuracy (18.6) in the "Very High" category. Therefore, it is concluded that the implementation of the RAG architecture successfully created an effective, accurate, and user-friendly chatbot for public service legal guidance.

Keyword: public services, artificial intelligenc, Retrieval-Augmented Generation.

GLOSSARY

LangChain	an open-source framework for developing applications powered by Large Language Models (LLMs).
OpenAI	an artificial intelligence research company that develops language models.
Chroma	an open-source vector database used to store and retrieve document embeddings (vector representations).
RAGAS	a framework designed to evaluate the performance of RAG-based systems by measuring aspects such as answer relevance, factual consistency, and contextual accuracy.
ChatGPT	a conversational AI model based on OpenAI's GPT architecture, designed to generate human-like responses and used in various chatbot and language-based applications.
FastAPI	a modern, high-performance web framework for building APIs with Python.

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CHAPTER I

INTRODUCTION

1.1 Background

Relation between public community and public service institutions often facing problems. Public service institutions, including both the government and private enterprise have the obligation to provide services that are fair, transparent, and outstanding. However, in reality misconduct frequently occurs such as maladministration, abuse of authority, and procedural impropriety. Therefore, the strong application of legal framework is necessary to ensure that public rights are protected and public services operate effectively.

Despite the establishment of regulations, instances of injustice or negligence in implementation are not uncommon. Phenomena such as bureaucratic inefficiency, illegal levies, or discrimination in public services demonstrate that society needs an independent institution that can monitor and handle complaints related to maladministration. This is where the role of the Lembaga Ombudsman Daerah Istimewa Yogyakarta (LO DIY) becomes very important, by mediating between the community and Service Provider Institutions to ensure that existing legal products are properly implemented and every citizen receives their rights in public services (Ida, 2025).

During the period of 2021-2023, LO DIY has received many consultations from the public regarding the implementation of public services and business ethics practices of business entities. In 2021, LO DIY received a total of 187 (one hundred and eighty-seven) cases, in 2022 a total of 270 cases, and in 2023 a total of 206 cases, as shown in Table 1.1 (Lembaga Ombudsman DIY, 2025). The table explains the number of complaints, consultations, and final products produced by Lembaga Ombudsman Daerah Istimewa Yogyakarta from 2021-2023.

Table 1.1 LO DIY Performance Statistics Table for 2021-2023

Year	Cases	Consultations	Final Products
2021	a. Government Agencies: 22 b. Private Enterprises: 52 c. Total: 74	a. Government Agencies: 83 b. Private Enterprises: 80 c. Others: 24 d. Total: 187	a. Government Agencies: 17 b. Private Enterprises: 35 c. Total: 52
2022	a. Government Agencies: 38 b. Private Enterprises: 67 c. Total: 105	a. Government Agencies: 111 b. Private Enterprises: 146 c. Others: 13 d. Total: 270	a. Government Agencies: 40 b. Private Enterprises: 69 c. Total: 109
2023	a. Government Agencies: 21 b. Private Enterprises: 47 c. Total: 68	a. Government Agencies: 92 b. Private Enterprises: 104 c. Others: 10 d. Total: 206	a. Government Agencies: 30 b. Private Enterprises: 75 c. Total: 105

Various factors influence the emergence of public service cases in society, such as population growth, public awareness of their rights, and supervision of public services. As technology and information develop, people are becoming more active in reporting various forms of maladministration, such as service delays, illegal levies, and discrimination. Additionally, bureaucratic complexity that is not balanced with effective administrative reform leads to an increasing number of complaints related to government service inefficiency. The lack of transparency and accountability in public service delivery also worsens the situation, resulting in many exposed cases that demonstrate the need for comprehensive system improvements.

In social life, law plays an important role in maintaining order and justice in society, especially in providing protection against maladministration in public institution services. Through various regulations and oversight mechanisms, the law ensures that every public institution performs its duties transparently, accountably, and in accordance with good service principles. When deviations occur, such as abuse of authority, prolonged delays, or unprofessional actions, the public can file objections or seek justice through legal channels. Thus, law not only serves as a control tool for public institutions but also provides guarantees for society to receive fair and quality services (Prasetio et al., 2024).

Legal literacy becomes very important for all society members to ensure the sustainability of community life. On the other hand, the complexity and abundance of legal documents

require efficient management, retrieval, and analysis methods. To provide broad understanding to the public, techniques that facilitate access to legal information are needed. Traditional manual processes are no longer able to meet the demands for timely and accurate legal information. Therefore, advanced technological solutions are required to address these challenges.

To improve public service legal literacy in society, technology must provide easy access to such information. One effective solution is an artificial intelligence (AI) based system capable of providing relevant and easily understood legal responses. This technology enables people to understand public service law comfortably and without hesitation, allowing them to gain a better understanding of their rights and obligations in public service law.

Generative Artificial Intelligence is a key technology in the development of artificial intelligence, encompassing computational techniques capable of producing meaningful content such as text, images, or audio, based on data (Abburi et al., 2023). In recent years, interest in utilizing generative artificial intelligence technology has increasingly grown. The rapid development in LLM capabilities and their ease of use in creating complex and coherent content has driven the production of AI-based content in large quantities (Lewis et al., 2020).

Large Language Models (LLM) have become a technology that plays a significant role in chatbot development, especially in improving the quality of interaction between users and systems (Dam et al., 2024). ChatGPT is one of the technologies that utilizes Large Language Models (LLM). Thus, models like ChatGPT are designed to understand and generate text with broad context, enabling chatbots to provide more natural and relevant responses (Meyer et al., 2023). By leveraging LLM capabilities, chatbots can provide more accurate and contextual legal information, helping society understand legal aspects related to public services.

In this study, we utilize Large Language Models (LLM) for information retrieval within legal document products using LangChain and OpenAI with a Retrieval-Augmented Generation (RAG) model approach. This model is capable of providing more factual and context-specific understanding of relevant documents (Wu et al., 2024). In a specific domain such as law, the Retrieval-Augmented Generation (RAG) model is highly suitable for building a more specialized Large Language Model (LLM) by leveraging a dedicated knowledge base (Cui et al., 2025).

According to recent studies by Lewis et al. (2020), Wu et al. (2024), and Gao et al. (2023), the application of Retrieval-Augmented Generation (RAG) in the legal and public service sectors shows potential for enhancing the accuracy of responses in AI-based systems. This

approach not only mitigates the risk of model-induced "hallucinations" but also improves decision-making transparency by citing specific reference sources (Wu et al., 2024). This aspect is crucial for question-answering systems operating within the legal domain. Furthermore Lewis et al. (2020) said, RAG is capable of adapting to specific domains, enabling government or legal institutions to integrate legislative databases in real-time. Consequently, retrieval-based augmentation ensures that generative outputs remain accurate, contextual, and verifiable in accordance with public sector and legal standards (Gao et al., 2023).

Although previous studies have demonstrated the effectiveness of applying Retrieval-Augmented Generation (RAG) in improving the accuracy and relevance of QA System -based question-answering systems in certain fields, the focus of such research has been largely confined to delivering information from specific and textual domains. However, limited research has explored the application of RAG in the context of public services, particularly in addressing the complex informational needs related to law and public administration, which are often directly linked to citizens' rights and the responsibilities of government institutions.

Thus, this technology has the potential to automate various aspects of legal processes, improve access to legal information, and enhance the efficiency of legal institutions, thereby helping the public better understand public services legal and the service provided by Lembaga Ombudsman DIY. With its ability to present information based on valid sources, this technology can increase public access to legal information that was previously difficult to comprehend due to complex language or limited official information channels. Furthermore, the operational efficiency of legal institutions and public service providers can also be improved by reducing administrative burdens and accelerating information-based service processes. Consequently, the implementation of this technology not only supports public understanding of legal products but also serves as a foundation for developing innovative solutions to strengthen the legal system in creating a more inclusive, responsive, and transparent public service.

1.2 Research Question

The question raised is based on the background of the problem, which is “How to utilize Retrieval-Augmented Generation (RAG) to provide guidance on public services legal procedures and rights?”.

1.3 Research Scopes

The scopes that found for this research, are:

- a. The QA System that is built only serves questions related to public service legals and services provided by Lembaga Ombudsman DIY.
- b. The QA System that is built only provides information related to public service legals and services provided by Lembaga Ombudsman DIY.
- c. The QA System that is built only to provide information with text form.

1.4 Research Objectives

The objectives for this research, are:

- a. To identify what is needed to build and develop a QA System application for legal institutions.
- b. Developing a QA System that can effectively assist the users in accessing relevant legal information and guidance.
- c. Enhancing the QA System's capabilities to offer guidance on legal procedures, rights, and case-specific inquiries.

1.5 Benefits of Research

The benefits for this research, are:

- a. Facilitating the general public's access to legal documents.
- b. Assisting users in obtaining legal information effectively by providing relevant content and guidance.

1.6 Writing Systematics

The systematics of the writing in this research consists of several main sections as follows:

- a. Chapter 1: Introduction

This chapter contains the background of the application to be developed, the formulation of the problems in this research, the objectives of the application development, the benefits of the application, the research methods used, and the structure of the writing.

- b. Chapter 2: Literature Review

This chapter includes the theories that form the basis of the conducted research and a review of several QA System applications or similar systems.

c. Chapter 3: Research Methodology

This chapter contains the analysis of the required system, including problem identification, solution design along with its requirement analysis, and system design derived from the system analysis in the form of Activity Diagrams and interface designs.

d. Chapter 4: Result and Discussion

This chapter provides an explanation of the implementation results, along with the evaluation results from the tests conducted by experts.

e. Chapter 5: Conclusion

This chapter presents the conclusions drawn from the process, results, and evaluations throughout the research, along with suggestions for improvements and future development of the application.

CHAPTER II

LITERATURE REVIEW

2.1 Lembaga Ombudsman Daerah Istimewa Yogyakarta

Lembaga Ombudsman Daerah Istimewa Yogyakarta (LO DIY) is an institution that monitors the implementation of public services by the government and commercial companies. LO DIY was established to create a transparent government and local government, free from corruption, collusion, nepotism, abuse of power or office, and arbitrary actions, in order to improve the quality of public services and provide legal protection for the community. Furthermore, the existence of the Lembaga Ombudsman Daerah Istimewa Yogyakarta (LO DIY) is an indicator of the realization of democracy and the main means of maintaining good governance, protecting citizens' rights, government accountability, and economic improvement (Lembaga Ombudsman DIY, 2025b).

In Governor Regulation Number 72 of 2022, it is stated that the LO DIY is a non-structural institution entrusted by the Governor and administratively coordinated by the Regional Secretary of DIY through the Regional Apparatus. LO DIY is expected to carry out government duties in the legal field. LO DIY was established by the DIY Government, originating from the initiative of the Center for Human Rights Studies at the Islamic University of Indonesia (PUSHAM UII) in Yogyakarta, with the support of cooperation in efforts to reform governance in Indonesia (Ida, 2025).

PUSHAM UII conducted observations to evaluate public assessments of the bureaucracy's performance in Yogyakarta, which was the beginning of the formation of LO DIY. Additionally, a meeting was held in Jakarta with the National Ombudsman Commission to assess the working process, performance, and current obstacles. After these two activities, intensive socialization was carried out in Yogyakarta for three months through various media, such as discussions and promotions in cinemas. The research and socialization results showed that the community needed a Regional Ombudsman institution. In September 2003, a workshop was held involving the executive, parliament members, community leaders, academics, and non-governmental organizations to support the idea.

The Provincial Government of DIY and UII Yogyakarta reached an agreement on June 10, 2004. With this agreement, the two institutions would support the establishment of the Lembaga Ombudsman Daerah Istimewa Yogyakarta and other initiatives related to public

service governance in the legal, government, and social sectors in DIY. This cooperation was valid for three years from the signing date and involved various stakeholders.

On June 30, 2004, the Governor of DIY issued Decree Number 134/2004 concerning the Formation and Organization of the Regional Ombudsman in the Province of DIY, based on three main considerations. First, providing fair and equal services to the community is a key element in creating regional government and law enforcement institutions free from corruption, collusion, nepotism, abuse of power, and arbitrary actions. Second, to ensure optimal service for the community, empowerment through active participation is necessary to oversee local government practices and law enforcement institutions. Third, the LO DIY is regarded as an anti-corruption institution recommended in the MPR Decree No. VIII of 2001 regarding the state policy of being free from corruption, collusion, and nepotism (Ida, 2025).

2.1.1 Purpose of Establishing LO DIY

The purpose of establishing Lembaga Ombudsman Daerah Istimewa Yogyakarta (LO DIY), as established in Governor Regulation No. 72 of 2022. It is to create clean and professional governance and business practices free from corruption, collusion, and nepotism. Additionally, LO DIY plays a role in improving the quality of public services based on legal certainty, justice, and equality, ensuring that every citizen receives fair legal protection. Through facilitation and mediation, LO DIY also seeks to promote professional and ethical business practices, allowing society to experience greater justice, security, and well-being. This principle aligns with the Javanese philosophy “Amemangun Karyenak Tyasing Sesami”, which emphasizes the importance of building a life that brings comfort and peace to others.

2.1.2 Function of LO DIY

Lembaga Ombudsman Daerah Istimewa Yogyakarta (LO DIY) has the primary duty of overseeing government administration and business entities, particularly in public service delivery. Its functions include developing work programs, disseminating awareness about LO DIY's role, and coordinating with various government agencies and business entities to establish clean and professional governance. Additionally, LO DIY manages and follows up on public complaints, strengthens efforts to prevent irregularities, reviews policies related to governance and business sectors, and submits periodic reports to the Governor every three months and at the end of the year.

2.1.3 Authority of LO DIY

LO DIY has the authority to provide input on government and business policies, as well as to follow up on alleged irregularities based on applicable regulations. The institution can request information from various parties, including complainants, reported individuals, government agencies, and business actors, to clarify complaints. Furthermore, LO DIY is authorized to present, monitor, and recommend solutions for received complaints and report the outcomes to the Governor through relevant regional offices. The institution may also publish recommendations and information regarding high-quality public services, subject to the Governor's approval.

2.2 QA System

A Question Answering (QA) System is a branch of information retrieval and natural language processing that focuses on providing users with concise and accurate answers to questions expressed in natural language (Farea & Emmert-Streib, 2025). Unlike traditional search engines that return entire documents, QA systems are designed to directly extract the most relevant information (Kell et al., 2024). These systems function through a structured framework consisting of question processing, document processing, paragraph extraction, and answer extraction, which work together to transform user queries into precise responses (Farea & Emmert-Streib, 2025). QA systems can be categorized into open-domain, which cover a broad range of topics, and closed-domain, which focus on specific fields such as medicine or education. Various approaches have been developed to improve QA performance, it has unique advantages depending on the type of data and query complexity (Kell et al., 2024). Beyond their technical framework, QA systems have wide applications in areas such as language learning, online examinations, knowledge management, and human-computer interaction. However, challenges remain in handling context, multilingual queries, real-time processing, and advanced reasoning. Despite these limitations, QA systems play a critical role in enhancing access to knowledge and improving efficiency in information retrieval, making them highly relevant in today's data-intensive environment.

2.3 Chatbot

While the system built in this research is classified as a Question Answering (QA) System, the literature also reviewed on chatbot technologies, due to the conceptual and technical similarities between the two particularly in their reliance on natural language

processing and their function as interactive tools for information retrieval. Along with AI technology advances, its integration into various software engineering tasks is becoming increasingly widespread. A study by Sridhara et al. (2023) examined fifteen software engineering tasks performed with the assistance of ChatGPT, demonstrating that its performance surpassed that of humans in several aspects. These tasks included requirements gathering, test case generation, code review, and log summarization. The findings suggest a future scenario where AI could independently handle a significant portion of software development tasks. However, this trend raises questions about the future role of software engineers and its potential impact on their jobs. As AI takes over more routine responsibilities, software engineers must continuously enhance their skills and update their knowledge to remain relevant in the ever-evolving technological landscape. Although this study provides valuable insights, it does not delve deeply into how the transition to AI-driven tasks might affect long-term career trajectories, skill development, team dynamics, or job satisfaction within software engineering.

Generative AI models like ChatGPT have garnered significant attention due to their advanced natural language processing and generation capabilities. Sok & Heng (2023) explored ChatGPT's potential, highlighting both its strengths and inherent limitations. A key concern raised is the model's tendency to generate inaccurate information, necessitating thorough verification and validation by software developers. As AI technology progresses, addressing these challenges becomes crucial to ensuring the reliability and trustworthiness of AI-generated outputs in practical applications.

The rapid advancement of AI technology, as exemplified by tools like ChatGPT, has drawn significant attention within the software development community. Kuhail et al. (2024) examined the capabilities and limitations of ChatGPT and other AI tools in software development, offering insights into their practical applications and real-world effectiveness. The study highlights both the benefits and challenges of AI-based solutions, contributing to a deeper understanding of how AI technology can enhance traditional software development practices. However, the research does not yet fully address the long-term impact of AI tools on software development workflows, the evolving role of developers, or the broader implications for industry standards and practices.

2.4 Generative AI

The term generative AI refers to computational methods capable of creating new and meaningful content, such as text, images, or audio, based on training data. Generative AI being used for artistic purposes, such as generating text that mimics an author's style or images resembling illustrations, generative AI systems can also serve as intelligent question-answering tools to assist humans. Generative AI models are a type of machine learning architecture that use AI algorithms to produce new data by recognizing patterns and relationships within training data. While these models are highly important, they aren't fully complete on their own and need further refinement to handle specific tasks through tailored systems and applications. (Feuerriegel et al., 2023)

Generative AI has great potential in supporting long-term learning processes by providing access to extensive, diverse, and relevant information. This technology can generate content tailored to users' needs, enabling individuals to explore various topics in depth and accelerate the understanding of complex concepts. With its ability to analyze large amounts of data, Generative AI can present updated and structured information, thereby enrich the learning process and enhance the quality of acquired knowledge. (Brynjolfsson et al., 2023)

2.5 Large Language Models (LLM)

Large Language Models (LLMs) has been remarkable in recent years, becoming a cornerstone of modern societal transformation (Mahendra and Styawati, 2024). In 2023, Indonesia ranked third globally in Artificial Intelligence (AI) adoption, with Indonesian internet users contributing 5.60% of the total 1.4 billion AI accesses in global traffic (Mahendra and Styawati, 2024). Large language models are extensive deep learning models that have been pre-trained on massive datasets (Petroni et al., 2020).

Despite being a relatively new technology, LLMs have significantly impacted the field of Natural Language Processing (NLP) (Hamarashid et al., 2023). These models have been instrumental in creating new chatbots and virtual assistants capable of understanding challenging queries and providing more human-like responses (Lund et al., 2023). Furthermore, they have been utilized to generate novel content, including news articles, product descriptions, and even complete books. GPT (Generative Pre-trained Transformer) stands out as one of the largest and most powerful language models ever created. It comprises 175 billion parameters and has been trained on a colossal dataset containing over 45 terabytes of text data.

GPT has been applied in various domains, from chatbots and virtual assistants to creative writing and even coding (Bryant, 2023).

The advent of large language models has revolutionized the field of artificial intelligence, offering numerous applications. Among these models, GPT is a widely adopted and powerful instrument. Many ChatGPT applications have proven effective, such as chatbots, content creation, language translation, personalized recommendations, and even medical diagnosis and therapy. Its ability to generate human-like responses, comprehend natural language, and adapt to diverse situations has contributed to its success across various applications (Lund et al., 2023). As an LLM, ChatGPT demonstrates remarkable adaptability and precision in NLP tasks. However, it also possesses certain drawbacks, including a tendency to produce biased responses and the potential to reinforce negative linguistic patterns.

Further previous research related to Large Language Models includes studies from Soygazi and Oguz (2023), Shu et al. (2024), and Mali et al. (2024). These studies utilized legal data and PDF format data, focusing on the rapid application development using LLM technology. The results demonstrated ChatGPT's proficiency in interpreting, comprehending, and utilizing information effectively.

Moreover, studies Guntoro et al. (2020) and Hariansyah et al. (2023) support the development of question-answering systems and chatbots. These works describe the use of web-based question-answering systems and chatbots as software capable of providing interactive responses in various contexts, such as academic chatbot systems and information services at Madani Pekanbaru Hospital. Research concerning OpenAI, specifically studies Patra and Kirtania (2023) and Younis et al. (2023), highlights the high potential of OpenAI technology in enhancing the quality and efficiency of various information technology applications, particularly in terms of more intelligent analysis, comprehension, and information utilization.

Large Language Models have become a crucial component in artificial intelligence, finding applications in diverse areas such as machine translation, content or text generation, natural language understanding, and sentiment analysis. These models have undergone significant developments recently, demonstrating remarkable progress in the field of Natural Language Processing (NLP). This literature review provides a comprehensive overview of the evolution of large language models, tracing their origins from early beginnings to their current state (Lund et al., 2023; Bryant, 2023).

The long history of large language models dates back to the development of Natural Language Processing (NLP) in the 1950s and 1960s. Rule-based systems and statistical techniques were the driving forces behind early efforts in this field. The Georgetown-IBM Experiment, which successfully transcribed 60 Russian words into English in 1954, marked the beginning of machine translation research. Despite its limitations, this experiment demonstrated the potential of applying computational tools to language processing (Lund et al., 2023).

2.6 Retrieval-Augmented Generation (RAG)

Retrieval-Augmented Generation (RAG) is an architecture that integrates information retrieval with text generation. Lewis et al. (2020) introduced this concept as a solution to enhance the quality of answers produced by natural language models by leveraging external information sources. This technique enables language models to retrieve relevant information from documents before generating a response, thereby improving the accuracy and relevance of the output.

RAG represents a novel approach that combines a pretrained language model with a retrieval mechanism to improve performance on tasks requiring complex knowledge. The two primary components of RAG are the retrieval system and the neural language model. The retrieval system extracts relevant information from a large corpus or database utilizing techniques such as keyword matching and semantic search to identify contextually relevant external data. In RAG, the retrieved information is integrated with the pretrained neural language model's knowledge, thereby creating a more comprehensive context. This integration enhances the relevance and accuracy of the generated content by incorporating specific and up-to-date information from external sources. While fine-tuning involves further training a pretrained model on a specific dataset to adapt it to a particular task or domain, it often requires significant computational resources for both training and operation of large language models (LLMs). Although not a conventional fine-tuning method, RAG can serve as an alternative for providing new knowledge to LLMs for various Natural Language Processing (NLP) tasks, including question-answering and text generation.

Retrieval-Augmented Generation (RAG) is frequently referred to as a new paradigm in chatbot development, where information from a retrieval mechanism is utilized to improve the quality of generated responses. Within the context of digital library information systems, RAG allows chatbots to retrieve pertinent information from library collections or other databases

when generating responses to users. The RAG process starts with retrieval, where the system pulls information from a data source. As shown in Figure 2.1, the data is split and embedded to ensure response accuracy. The retrieved information is then combined with LLM to create responses that are both relevant and detailed. This method mitigates the shortcomings of purely generative models, which can be inaccurate or contextually irrelevant (Lewis et al., 2020).

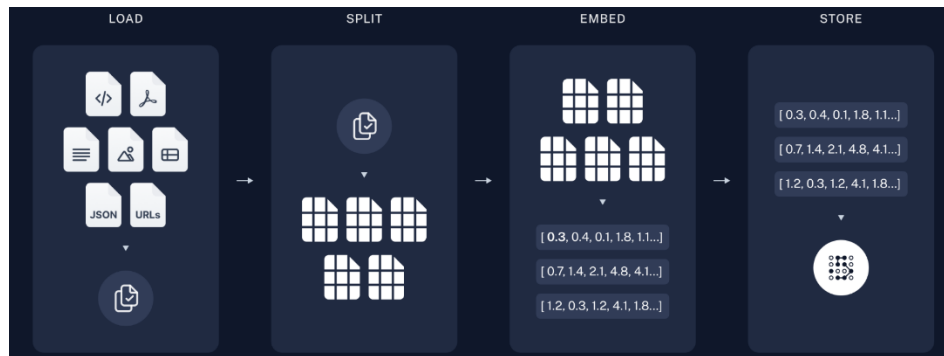


Figure 2.1 RAG Document Process

Source: Build a Retrieval Augmented Generation (RAG) App: Part 1 | LangChain, n.d.

2.7 Literature Review

There are various in-depth studies on the use of LLMs and RAG using several methods and datasets. Previous studies show that the implementation of LLMs in chatbot-based question-answering systems has proven to increase the accuracy and relevance of the information provided. This aligns with the research results conducted by Lubis et al. (2024) who studied the application of LLMs for developing question-answering systems using Law No. 17 of 2023 on Health as the knowledge base. The chatbot that was built successfully provided answers to users with testing results using BERTScore achieving average precision, recall, and f1-score values of 76%, 80%, and 78% respectively. Meanwhile, for ROUGE-1 the scores were 60%, 45%, 50%, for ROUGE-2 they were 34%, 25%, 28%, and for ROUGE-L they were 45%, 34%, 38%.

Research from Permadi et al. (2024) developed a Telegram chatbot-based system that can receive questions about Tafsir Al-Azhar in natural language. The generated answers are composed using terms that are easily understood by users. This system was built by utilizing LangChain technology and Large Language Models (LLMs). The system testing results showed an accuracy of 83.71%, a hallucination score of 41%, contextual precision of 90%, and contextual relevancy of 79%. These results indicate that the system is capable of providing sufficiently accurate and relevant answers in Tafsir Al-Azhar.

Subsequent research by Tribber et al. (2024) tested the effectiveness of an artificial intelligence-based chatbot developed using the Retrieval Augmented Generation (RAG) approach to improve information services in educational institutions. The methods used include utilizing Large Language Models (LLMs) enhanced with RAG, implemented through a Telegram application to provide fast and accurate information access. Performance evaluation was conducted using the RAGAS tool, through testing on 10 sample questions. The test results showed a context precision score of 93%, faithfulness 100%, answer relevancy 96%, context recall 100%, answer correctness 71%, and answer similarity 93%. These findings indicate that RAG-based chatbots can be an effective solution for improving information accessibility in educational environments.

Furthermore, research conducted by Fanani (2025) aimed to develop a thesis title evaluation system based on Retrieval Augmented Generation (RAG) by utilizing a repository of final projects from the past year as a knowledge source. This system combines a retrieval component that uses semantic embedding techniques to identify similar titles from the repository, as well as a generative component that provides evaluation and improvement recommendations for the tested titles. The development process involved pre-processing data from the repository, implementing sentence-transformers models to build a vector database, and integration with Large Language Models (LLMs). Testing was conducted on 20 new thesis titles, with results showing an answer correctness value of 80%. These results indicate that the RAG system is capable of automating the title evaluation process more objectively and effectively.

Research conducted by Pratama and Sisephaputra (2024) developed a chatbot-based helpdesk system using the Retrieval-Augmented Generation (RAG) method to improve the efficiency of administrative services in the campus environment. The system was designed using FastAPI as the backend and Next.js as the frontend, resulting in a responsive and user-friendly interface. The chatbot utilizes text generation capabilities from the Gemini model combined with semantic search using FAISS DATABASE from OpenAI, enabling the presentation of accurate and relevant information in real-time. System testing showed that the chatbot was capable of handling various user questions simultaneously with fast and reliable responses. These results indicate that this system is effective in facilitating access to academic and administrative information, as well as simplifying user interactions with campus helpdesk services. Future development plans include server deployment and prompt configuration adjustments to further improve system accuracy and capabilities.

Based on previous studies, as summarized in Table 2.1, the use of the Retrieval-Augmented Generation (RAG) model has proven to be effective and optimal in various application domains. Building upon these findings, this study utilizes generative artificial intelligence for the purpose of information retrieval in legal document products. Specifically, we adopt the RAG model approach by integrating LangChain and OpenAI technologies to develop an innovative solution aimed at improving access to legal information within the context of public service law. This approach is expected to enhance the accuracy and relevance of retrieved legal content, while also supporting more efficient and intelligent interactions between users and legal information systems.

Table 2.1 Literature Review Summary

No.	Year	Title	LLM Framework	Dataset	Result
1.	2024	Question Answering System pada Chatbot Telegram Menggunakan Large Language Models (LLM) dan Langchain (Studi Kasus UU Kesehatan)	LangChain	Law Number 17 of 2023 concerning Health	Precision: 76%, recall: 80%, f1-score: 78%; ROUGE-1 scores of 60%, 45%, and 50%; ROUGE-2 scores of 34%, 25%, and 28%; and ROUGE-L scores of 45%, 34%, and 38%.
2.	2024	Implementasi Question Answering System Tafsir Al- Azhar Menggunakan Langchain Dan Large Language Model Berbasis Chatbot Telegram	LangChain	<i>Tafsir Al-Azhar</i>	The UAT resulted in an accuracy score of 83.71%, DeepEval framework yielded a hallucination score of 41%, contextual precision of 90%, contextual recall of 81%, and contextual relevancy of 79%.
3.	2025	Pengembangan Sistem Helpdesk Menggunakan Chatbot Dengan Metode Retrieval-Augmented Generation (RAG)	-	Publicly available information regarding the Universitas Negeri Surabaya (UNESA)	The chatbot satisfies established functional requirements.
4.	2025	Implementasi Retrieval Augmented Generation Untuk Evaluasi Proposal Tugas Akhir Mahasiswa	-	Undergraduate thesis from Politeknik Pajajaran ICB, Bandung	Answer Correctness: 70%-80%,
5.	2025	Implementasi Retrieval Augmented Generation untuk Layanan Informasi Kampus dengan Chatbot BerbasisAI	-	Information From Universitas Catur Insan Cendekia	Precision 93%, Faithfulness 100%, Answer Relevancy 96%, Context Recall 100%, Answer Correctness 71%, and Answer Similarity 93%.

2.8 Identification of QA System Evaluation

To ensure the quality and precision assessment in this research, the questionnaire instrument was developed by adopting indicators that have been proven valid and reliable based on the findings of previous studies. This approach was chosen to leverage the theoretical and empirical foundations of prior research, ensuring that the instrument employed has a robust scientific justification for measuring the constructs relevant to the research context. All indicators within the questionnaire are derived from widely recognized literature and have previously undergone validation and reliability testing in similar contexts. By adopting indicators from academic sources that have already undergone validity and reliability testing, the questionnaire in this study is presumed to possess an adequate degree of validity and reliability, as explained below.

a. Perceived Usefulness Indicator

Perceived Usefulness refers to the degree to which experts believe that using the QA System can provide real benefits to society and end-users Davis (1989). The validity of this indicator is supported by several studies using Perceived Usefulness as a measurement tool in chatbot implementation research. Drawing upon the concept of Perceived Usefulness, Zou and Huang (2023) developed a framework to explore the acceptance and usage patterns of ChatGPT among doctoral students in their writing. Meanwhile, study by Sánchez-Adame et al., (2021) applies expert-based evaluation, where five specialists reviewed an education-oriented chatbot through the proposed heuristics. Although the main emphasis lies on usability heuristics, the choice to involve experts corresponds to the methodological requirement of expert evaluation instead of end-user responses. Furthermore, a study by Alagarsamy and Mehroliya (2023) showed that Perceived Usefulness of chatbots positively impacts customer interaction with brands, offering strategic insights for managers designing technology-based customer experiences.

b. Accuracy Indicator

Chatbot answer accuracy refers to the degree of conformity between the system-generated answers and the users' questions. The construct validity has been confirmed through various studies using accuracy as a primary indicator to assess chatbot performance in diverse contexts. For example, Goodman et al. (2023) evaluated the accuracy and completeness of chatbot responses to medical questions designed by healthcare professionals, highlighting the

reliability and limitations of AI-generated medical information. A study by Ponzo et al. (2024) evaluated the accuracy of general-purpose AI chatbots in providing nutritional recommendations for patients with obesity, both with and without various comorbidities. Wagner and Ertl-Wagner (2023) assessed the accuracy of ChatGPT-3's answers to questions from radiologists' daily practice, including the quality of references supporting those answers.

c. Relevance Indicator

Based on previous research, relevance in chatbots refers to the system's ability to provide accurate and appropriate answers that match user questions, as well as its capability to understand the context of prior conversations to maintain relevance in responses. Gupta et al. (2022) examined the conformity of chatbot responses to questions posed, measuring the relevance level of the answers. Olszewski et al. (2024) evaluated the chatbot's relevance in the context of medical and health information. Yau et al. (2024) studied the relevance and completeness of chatbot responses to questions based on reputable and scientific emergency medical references.

d. Clarity Indicator

Clarity refers to the extent to which the language used by the chatbot resembles human conversational style, thereby facilitating comprehension and enhancing comfort during interaction. Numerous studies highlight the importance of this aspect as a key factor in the effectiveness of chatbot performance. Abouzeid et al. (2025) assessed the clarity of AI chatbots. Their study suggests that these chatbots can aid in producing questions aligned with learning objectives, though they also noted that individual chatbots have unique strengths and weaknesses. According to Maroncelli et al. (2024), the clarity offered by chatbots shows significant promise for serving patients from diverse backgrounds. Their findings indicate that Large Language Models (LLMs) such as ChatGPT-4o have the potential to simplify complex breast radiology reports, thereby improving communication and enhancing overall patient care.

Based on the literature review conducted, key evaluation factors include experts' confidence in the chatbot's potential societal benefits, the conformity of its answers with applicable laws, the relevance of responses to user queries, and the clarity and comprehensibility of the information and context provided. Therefore, the evaluation indicators

can be categorized into Perceived Usefulness, Accuracy, Relevance, and Clarity, as outlined in Table 2.2.

Table 2.2 Indicators for Questionnaire-Based Assessment

Indicators	Description
Perceived Usefulness	Measures the extent of experts' confidence in the chatbot's benefits for society
Accuracy	Assesses the extent to which the QA System's answers comply with applicable laws
Relevance	Measures whether the QA System's answers align with the questions asked
Clarity	Assesses how easily the QA System's answers can be understood

The QA System evaluation is carried out using a scoring approach based on questionnaire results with a Likert Scale. The assessment scale used in this study refers to a 5-point Likert scale, with the following rating range: score 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree), and 5 (strongly agree). In accordance with the guidelines proposed by Sugiyono (2021), analysis of the independent and dependent variables was carried out by calculating the mean value of each variable. The mean value was obtained by summing all respondent scores for each variable and then dividing by the number of respondents. The equation used for calculating the mean is as follows as in Equation (2.1).

$$Me = \frac{\sum x}{n} \quad (2.1)$$

- a. Me = Mean
- b. $\sum x$ = Sum of values from X/Y_1 to X/Y_n
- c. n = Number of respondents

After obtaining the mean scores of the independent and dependent variables, they were compared with predetermined criteria based on the lowest and highest possible scores from the questionnaire. These minimum and maximum values were derived by multiplying the number of questions in the questionnaire by the lowest (1) and highest (5) Likert scale values, respectively.

CHAPTER III

METHODOLOGY

The research methodology consists of four stages: requirement analysis, design, implementation, and evaluation. The research flow is illustrated in Figure 3.1. The methodology was systematically structured to facilitate a focused and measurable execution of each development phase. It encompassed the entire process, from the initial needs assessment to the final evaluation of the public service legal QA System system.

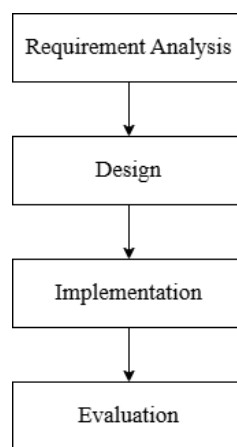


Figure 3.1 Research Flow

3.1 Requirement Analysis

The requirement analysis in this research was conducted in three stages: interviews and review of existing systems, data collection, and system requirements analysis. To fulfill the requirements of the research, this analysis was conducted at Lembaga Ombudsman Daerah Istimewa Yogyakarta (LO DIY). This research involved experts from LO DIY who demonstrate a strong understanding and substantial experience in legal matters related to public service. The main objective of this requirement analysis was to identify the challenges associated with using Generative AI for retrieving information on public service procedures and related legal regulations. Additionally, it aimed to formulate the system requirements for the development of a QA System capable of retrieving legal information relevant to public services, covering both functional and technical specifications.

3.1.1 Interviews and Review of Existing Systems

Interviews and a review of the existing system held with the expert from LO DIY, including a staff who responsible for information services and two commissioners to directly gather information regarding the flow and mechanism of public information provision. These steps were conducted to gain a deeper understanding of how the public currently accesses and finds available information from LO DIY such as complaint handling procedures, standard operating procedures (SOPs), reporting mechanisms, and legal references related to public services. Additionally, the review of existing systems focused on examining the tools, documentation, and procedures used to manage information requests. This includes whether digital systems are in place, how documents are categorized, and the extent to which legal references availability are made.

3.1.2 Data Collecting

At this stage, data collection was carried out directly at the Regional Ombudsman Institution of the Special Region of Yogyakarta (LO DIY). The process involved identifying both the types of documents and file formats used as sources of information related to public service supervision and relevant legal guidelines. The data collection process was divided into several stages, including a literature review, digital document searches, and direct communication with experts from LO DIY. These methods were employed to ensure the comprehensiveness and contextual accuracy of the collected data. The data used in this research consists of:

- a. Standard Operating Procedures (SOPs) for handling public complaints and delivering public services,
- b. Process flows and service guidelines for receiving, processing, and resolving complaints,
- c. Legal references, such as excerpts from laws, government regulations, and local policies applicable to public service oversight, and
- d. Supplementary information related to the procedures and mechanisms for public service delivery at LO DIY.

This data serves as the knowledge base for the QA System system, ensuring that it can generate responses that are consistent with applicable regulations and the institutional context.

3.1.3 System Requirements Analysis

The system requirements analysis for the development of a public service QA System focused on identifying the requirements to support an interactive and responsive information services. The analysis included aspects such as the ability to understand user intent, retrieve legal information relevant to public service complaints, and provide clear responses based on legal references and institutional guidelines. The requirement identification process was enriched through expert feedback from LO DIY, who have in-depth knowledge of public service demands and the legal context. This analysis aimed to ensure that the system could present an effective legal information that is accurate, contextual, and understandable for the society. Furthermore, the presence of this QA System is expected to enhance the quality of information retrieval services in the context of public service delivery.

3.2 Design

In this research, the system design process was conducted to ensure that the developed system genuinely meets user needs. This stage involved creating use case diagrams, activity diagrams, and designing the user interface to support user interaction. This design effort aimed to clarify the system's flow and functions in a structured and systematic manner. Consequently, the developed system is intended not only to be technically functional but also to provide a comfortable and efficient user experience.

3.2.1 Use Case Diagram

The design of the use case diagram was carried out to comprehensively understand the system's operational scenarios. This diagram illustrates the interactions between users and the system, thereby facilitating the identification of necessary functionalities (Aquino et al., 2021). By providing a clear visualization of system behavior, the use case diagram supports the development of a system flow that aligns with user needs and expectations. For example, Figure 3.2 shows the use case diagram implementation for chatbot. Since this study only implements a QA System, the use case diagram focuses on a single primary user: the general public seeking information related to public services, including legal regulations and procedural requirements. By concentrating on this user profile, the development of the QA System can proceed in a more focused, efficient, and goal-oriented manner.

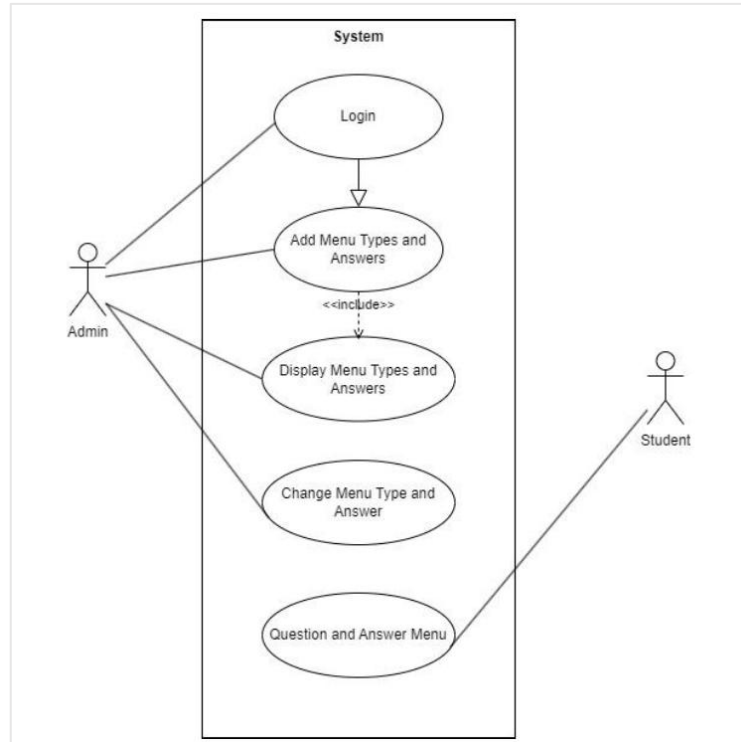


Figure 3.2 Example of Use Case Diagram

Source: “Designing Flow-Based Chatbot as Student Information Service Center,” 2024

3.2.2 Activity Diagram

Activity diagrams in this research are used to model the workflow processes within the QA System application. These diagrams play an important role in visualizing the internal operations of the QA System and ensuring that user question processing occurs efficiently. An activity diagram is a visual representation that illustrates workflows or processes in a system, showing how activities transition in a structured sequence from one stage to another (Jha et al., 2023). In this study, the activity diagrams are designed to visualize the use case diagrams previously developed as visualized in Figure 3.3. By utilizing standardized symbols, activity diagrams enhance understanding of activity sequences, decision points, and the flow of data or control throughout the analyzed process. Therefore, activity diagrams are essential in application development as they support the efficient organization and design of process flows.

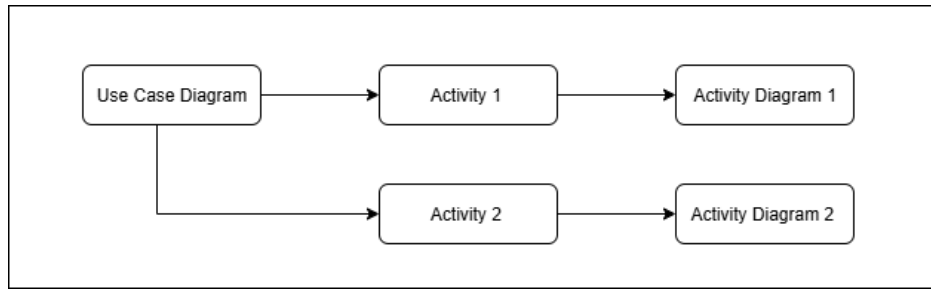


Figure 3.3 Activity Diagram Flow

3.2.3 Interface

The user interface design process was carried out to determine the essential elements required in the application and how these elements should be arranged to support ease of use. This design process considered not only technical aspects but also prioritized user comfort and experience. Consequently, the resulting system is not only functionally effective but also easy to understand, access, and use, in accordance with the application's intended purpose. The interface will be implemented using standard frontend technologies, including HTML, CSS, and Bootstrap, to ensure a responsive and visually consistent layout. Additionally, JavaScript will be used to support dynamic interactions and facilitate integration with the back-end system.

3.3 Implementation

The implementation phase of the system was conducted through a series of interrelated stages as figured in Figure 3.4. It commenced with the aggregation and curation of relevant data sources, followed by document preprocessing aimed at generating vectorized representations of the textual content. These vectors were subsequently stored in a vector database to enable efficient semantic retrieval in response to user queries. The next stage involved the design and application of prompt mechanisms, which facilitated the integration of retrieved contextual information with user inputs. This was further incorporated into a Retrieval-Augmented Generation (RAG) framework to enhance the relevance and accuracy of system-generated responses. The final step entailed the full integration of all components into a cohesive QA System system designed to support public service information delivery.

The framework applied in the implementation of this system is LangChain, which serves as the orchestration layer that manages multiple components in the Retrieval-Augmented Generation (RAG) pipeline. Technically, LangChain is employed in three main aspects: data

processing, prompt implementation, and integration of RAG as shown in Figure 3.4. The data processing used LangChain to handle the transformation of raw legal documents into embeddings that can be stored and efficiently retrieved in a vector database. While in prompt implementation, it used to structure and format the query together with the retrieved context into a prompt that can be understood by the Large Language Model and integration of RAG, used to connect the user query with the retriever module, gathers the most relevant passages, and forwards them to the LLM. In this setup, the input is the user's natural language query, which goes through data retrieval and prompt construction, and the output is a contextually grounded response generated by the system.

The Large Language Model (LLM) used in this research is OpenAI's GPT-4, which is specifically positioned in the prompt implementation and response generation stage. After LangChain prepares the prompt by combining the user query with the retrieved legal context, GPT-4 processes this input and generates a linguistically coherent, context-aware, and legally relevant answer. Thus, while LangChain ensures data processing, retrieval, and prompt structuring, the role of OpenAI GPT-4 is to serve as the generative engine that produces the final output delivered to the user in the form of accurate legal information.

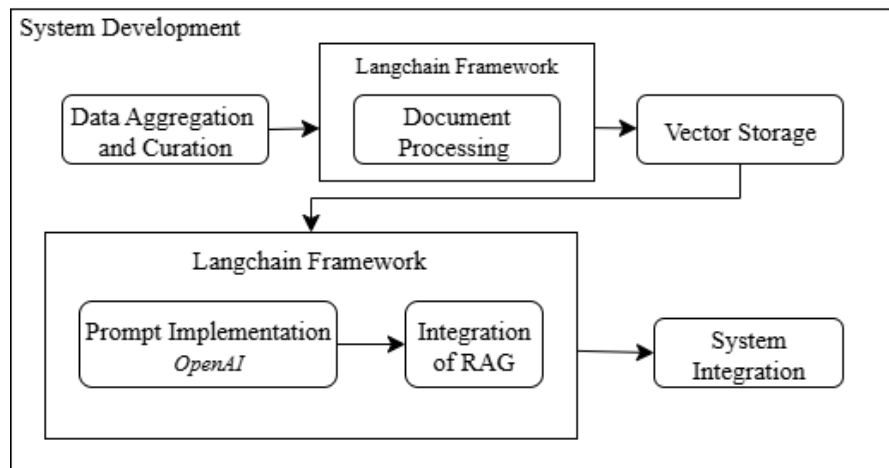


Figure 3.4 System Flow

3.3.1 Data Aggregation and Curation

At this stage, the collected data will be processed into a knowledge base that will be integrated into the system. This process involved collecting legal documents related to public services from credible sources, such as national legislation, local regulations, standard operating procedures, and official service guidelines. These documents were then cleaned by

removing irrelevant sections, standardizing formats, and organizing the content into structured formats suitable for further processing. This process as shown in Figure 3.5 ensures that the information used is relevant, accurate, and tailored to user needs, especially in the context of providing legal information.

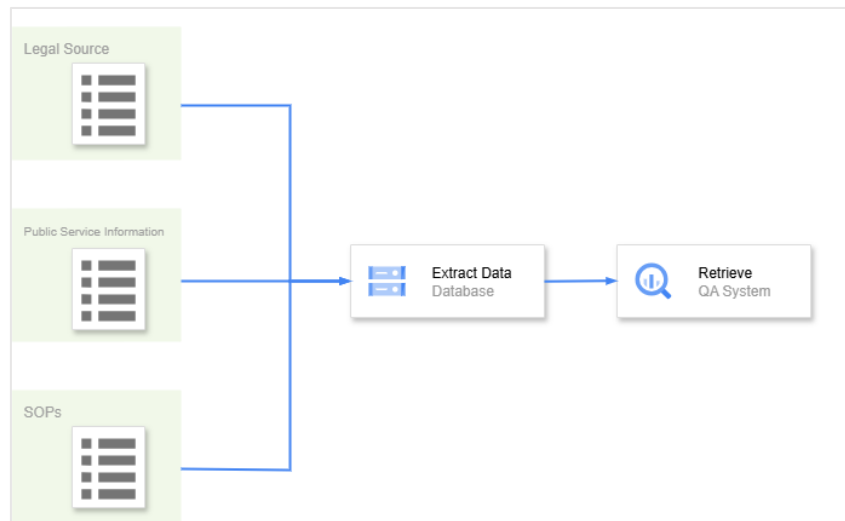


Figure 3.5 Data Aggregation and Curation Flow

3.3.2 Documents Processing in QA System System Implementation

This stage is determining the main components that form the QA System architecture, including the selection of the language model, information retrieval mechanism, and user interface. The framework used is LangChain with the Retrieval-Augmented Generation (RAG) approach, which enables integration between language understanding capabilities and information retrieval from external data sources. The Large Language Model (LLM) employed is GPT-4, which has strong abilities in understanding context and generating relevant responses, particularly in conveying legal information.

3.3.3 Integration of Retrieval-Augmented Generation (RAG) Architecture in the QA System

This system employs the Retrieval-Augmented Generation (RAG) approach. By combining the GPT-4 language model's capabilities with access to relevant legal documents, this approach offers several advantages. One is the ability to understand legal issues more factually and contextually. Moreover, the QA System helps non-expert users comprehend the legal information presented by providing explanations that are easier to understand. The use of

RAG also helps reduce the risk of generating responses not based on valid data or documents, thereby enhancing the accuracy and credibility of the information provided (Lewis et al., 2020).

3.3.4 Integration and Initial Evaluation of the System

At this stage, integration is performed among all system components, including natural language processing modules, information retrieval mechanisms, the knowledge base, and the previously designed user interface. This integration aims to ensure all parts function cohesively and operate according to the planned workflow. After integration, initial testing is conducted by submitting a series of questions to the QA System. This testing evaluates the QA System's ability to provide accurate, relevant, and contextually appropriate responses. It also assesses interface design and user interaction aspects to confirm that the visual design and functionality align with initial designs and are user-friendly.

3.4 Evaluation

The evaluation stage includes two main stages evaluation: expert evaluation and user evaluation. It aims to ensure that the QA System application meets the established requirements and functions properly. At the evaluation stage, QA System results are tested to assess system performance.

3.4.1 Expert Evaluation

Evaluation is conducted through surveys and interviews with public service legal experts who review the search results and provide detailed feedback. The approach used in the evaluation analysis is descriptive analysis. Key aspects tested include the QA System's ability to understand questions, respond appropriately, and provide relevant answers related to legal documents. The test also evaluates the QA System performance through expert opinions.

This process involved five experts from the LO DIY who were tasked with assessing the appropriateness of the information intended for users. These experts hold the position of commissioners, who serve as the leaders of the institution. Five out of the seven active commissioners participated in this evaluation.

Each expert was provided with a comparison sheet presenting QA System responses generated by two different systems: one integrated with Retrieval-Augmented Generation (RAG), and one without RAG. The QA System was prompted with several questions, and the

responses from both systems were compared side by side. The questions posed to the QA System were categorized into three main themes:

- a. Service complaint procedures
- b. Knowledge related to business processes and public services, and
- c. General information about LO DIY.

Following the review of the comparison sheet, experts were asked to complete an evaluation questionnaire and provide qualitative feedback based on their observations. A summary of this evaluation framework is presented in Table 3.1.

Table 3.1. Table of Questionnaires

No.	Indicator	Questions	Score				
			SA	A	N	D	SD
1.	Perceived Usefulness	This QA System helps the public understand legal procedures that must be followed to access public services.					
2.		This QA System can reduce public misunderstanding regarding rules and provisions in the implementation of public service.					
3.		I recommend this QA System to be used as a tool to assist in legal education related to public service.					
4.	Accuracy	The RAG based QA System's response comply with laws and regulations governing public service delivery.					
5.		The RAG based QA System does not provide information that contradicts public service legal standards.					
6.		The RAG based QA System provides references to applicable regulations or policies in public service delivery.					
7.		I believe this QA System can serve as an initial reference in understanding rights and obligations in public service.					
8.	Relevance	RAG based QA System's response clearly refers to relevant regulations or policies related to public service delivery questions.					

9.		RAG based QA System's response is more relevant than Non-RAG based QA System's response 1.					
10.	Clarity	The QA System's responses are well-structured and do not cause confusion in understanding public service rights and obligations.					
11.		The QA System avoids using overly technical legal terms and provides adequate explanations within the context of public service.					

The QA System evaluation was carried out using a questionnaire-based approach, with indicators adapted from relevant prior studies. These indicators were selected based on their relevance to the research focus, as discussed in Chapter 2. The indicators include Perceived Usefulness, Accuracy, Relevance, and Clarity. In the questionnaire, these indicators were translated into a series of structured questions designed to capture expert perceptions. After the responses were obtained, the data were processed and analyzed to support the research analysis.

The evaluation in this study adopts four key indicators: Perceived Usefulness, Accuracy, Relevance, and Clarity. These identified through an extensive literature review and supported by prior empirical findings, as outlined in Chapter 2. These indicators serve as the basis for assessing the effectiveness of the QA System in delivering legal information related to public service.

Perceived Usefulness reflects the extent to which experts believe the QA System offers tangible benefits to society. Rooted in Davis's (1989) Technology Acceptance Model and further supported by contemporary studies (Zou & Huang, 2023; Iancu & Iancu, 2023; Alagarsamy & Mehroliia, 2023), this indicator was operationalized through three questionnaire items. The items aim to capture expert trust in the system's value and its potential to enhance public access to information. A 5-point Likert scale was employed, and responses were analyzed descriptively to interpret respondents' perception levels.

Building upon this, Accuracy assesses the QA System's capability to provide precise answers aligned with existing legal frameworks. This indicator has been widely utilized in the evaluation of legal information systems (Goodman et al., 2023; Ponzo et al., 2024; Wagner & Ertl-Wagner, 2023). In this study, four questionnaire items were formulated to examine both the factual correctness of the answers and the system's ability to cite relevant regulations

clearly. As with the previous indicator, a 5-point Likert scale was used, and the results were interpreted through descriptive statistical analysis based on score intervals.

Complementing Accuracy, the Relevance indicator evaluates the alignment between user queries and the responses generated by the QA System, particularly in the context of public service law. Drawing upon established theories and supported by prior research (Gupta et al., 2022; Olszewski et al., 2024; Yau et al., 2024), this indicator was captured through two questionnaire items. These items measured the appropriateness of information delivery and included a comparative assessment between the RAG-based system and a non-RAG baseline.

Lastly, Clarity concerns the comprehensibility of the system's responses, particularly their accessibility to non-expert audiences. Grounded in recent evaluations of user-oriented legal systems (Abouzeid et al., 2025; Maroncelli et al., 2024), this indicator was measured through two items focusing on the ease of understanding and the effectiveness of information presentation. Like the other indicators, responses were collected using a 5-point Likert scale and categorized through interval-based descriptive analysis to determine expert perceptions.

3.4.2 User Evaluation

To support the overall evaluation of the system, an additional assessment was conducted specifically involving members of the public who represent potential end-users of this system. The assessment engaged ten respondents in total, comprising five workers who represent the employed community segment and five students who represent more academically engaged demographic. This composition was intentionally chosen to capture a balance of experiences, backgrounds, and information needs, thereby providing a more comprehensive view of the system's usability and clarity.

During the evaluation, these respondents were presented with comparative answers generated by both the RAG-based system and the non-RAG system. By exposing participants to outputs from the two different approaches, the study aimed to highlight whether the integration of RAG contributes to clearer and more contextually accurate responses. To further measure the degree of comprehension, respondents were subsequently asked a series of follow-up questions designed to assess their understanding of the QA System's answers, particularly those generated with RAG. The results of this assessment are essential in determining the extent to which the QA System can deliver outputs that are not only technically accurate but also accessible and easily understood by the general public as potential users.

CHAPTER IV

RESULT AND DISCUSSION

This chapter presents and elaborates on all results from the series of research processes that have been conducted. The processes in question encompass several important stages, beginning with needs analysis aimed at identifying the components required in the system, followed by the design stage that formulates the system workflow conceptually. After the design phase, the implementation and development process of the QA System application was carried out by considering the results of the previous analysis to ensure that the built system could function as expected. Finally, a QA System testing stage was conducted to evaluate system performance and measure the extent to which the system can meet user needs, both in terms of functionality and the quality of responses generated.

4.1 Requirement Analysis Result

The requirement analysis in this research was conducted through a comprehensive information-gathering process involving the Lembaga Ombudsman Daerah Istimewa Yogyakarta (LO DIY). After conducting this information-gathering phase, all requirements were successfully collected through a combination of interviews and review of existing systems, data collection, and system requirement analysis. It can be concluded that this process successfully identified the essential information needed to support the development of a QA System system tailored to the legal public service context at LO DIY.

4.1.1 Result of Interviews and Review of Existing Systems

This process was conducted through interviews with experts from the LO DIY, include an assistant staff who responsible for information services and two commisioners. Based on the interview results, it was found that LO DIY is an independent institution that plays a strategic role in supervising the implementation of public services by government apparatus and business entities in the DIY region. The existence of this institution reflects a commitment to clean, transparent, accountable governance that is free from corruption, collusion, and nepotism practices. In its implementation, LO DIY handles various public complaints related to alleged deviations in public services through stages of consultation, clarification, investigation, and mediation, while upholding the principles of justice and confidentiality. All

services provided are free and open to the public, as part of implementing the local cultural value "Amemangun Karyenak Tyasing Sesami," which means building to prosper one another.

The current information search system used at LO DIY is still manual. It relies on customer service interactions via WhatsApp, Instagram direct messages, or telephone calls. According to the assistant staff, the system presents several challenges. Clients often ask general questions that are already available on the website, and the same questions are frequently repeated. Additionally, the quality of conversations through chat is considered inadequate. The system also lacks automated legal references for information retrieval, which leads to difficulties for both staff and clients in requesting and providing detailed information related to legal matters. In light of these limitations, there is a growing need for an automated system that can assist clients in searching for public service legal information at any time.

4.1.2 Data Collection

From the interviews conducted with LO DIY, various supporting documents were obtained, which are used by the institution as references in every complaint follow-up process. These documents serve as the primary sources for the development of the QA System in this research. The data used for the system are presented in Table 4.1.

Based on expert interviews, it was emphasized that the sources used as references are highly diverse and depend on the specific issues raised in each complaint. The details of the cases are strongly tied to the context of each individual case, requiring in-depth information that cannot be accessed by external parties. Therefore, the experts recommended using data for system development and initial testing that remain general in scope, but still specific within the context of public service law. In addition, many of the questions raised by the public are still relatively general in nature.

Apart from expert interviews, reference sources for the system were also derived from several Frequently Asked Questions (FAQ) available on the LO DIY website as shown in Figure 4.1. According to the experts, the development of these FAQs was also based on recurring questions submitted by the public. Consequently, this research limits the system to several general legal references that are frequently asked about by clients.

Table 4.1. Data Type and References

Data Type	Data References	Scopes
Standard Operating Procedures (SOPs) for handling public complaints	<ul style="list-style-type: none"> a. Expert Interviews b. Literature reviews from books used as official guidelines at LO DIY 	These data is used to provide detailed information regarding the provisions required by LO DIY in handling public service complaints.
Process flows and service guidelines	<ul style="list-style-type: none"> a. LO DIY Websites b. Expert Interviews c. Literature reviews from books used as official guidelines at LO DIY 	These data is used to provide detailed information regarding the service processes implemented by LO DIY.
Legal references	<ul style="list-style-type: none"> a. Law of the Republic of Indonesia Number 25 of 2009 on Public Services b. Law of the Republic of Indonesia Number 8 of 1999 on Consumer Protection 	These data are used as legal references for matters related to Public Services and Consumer Protection.



Figure 4.1 FAQ in LO DIY Website

Source: Lembaga Ombudsman DIY, 2024

4.1.3 Result of System Requirements Analysis

System requirements analysis for the development of a public service QA System by LO DIY is focused on identifying the input, process, and output requirements necessary to support information services in an interactive and responsive manner. In this system, the input provided by users consists only of questions regarding public service rights, complaint procedures, or information related to public service provider institutions. These questions are then processed by the QA System system that has been trained using relevant public service regulations and information data. The processes within the system include matching questions with the knowledge base, retrieving appropriate information, and automatically composing answers. The output generated is informative answers delivered directly by the QA System in conversation, without requiring users to fill in additional data. This requirements analysis serves as an important foundation in system design so that the QA System can answer public questions quickly, accurately, and accessibly, while supporting LO DIY's role in improving the quality of transparent and accountable public services.

4.2 Design

The design conducted for the research system was carried out according to user preferences, while ensuring that each design stage is well-documented. In this research, the design process includes the creation of use case diagrams, activity diagrams, and interface design.

4.2.1 Use Case Diagram

Use case diagrams help understand how users interact with the system to achieve specific objectives. In the developed system, the use case diagram illustrates one user connected to various processes within the system. The user in this diagram is referred to as "User". Further explanation regarding the use case diagram for the QA System application for legal document search can be seen in Figure 4.2. As depicted in the figure, the user can interact with the QA System by submitting questions and responding to the QA System's answers.

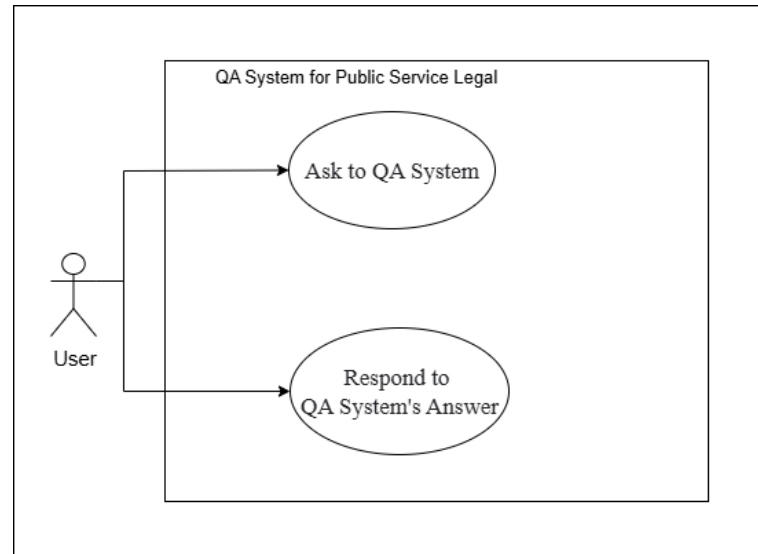


Figure 4.2 Use Case Diagram

4.2.2 Activity Diagram

Based on the use case diagram, there are two main activities performed by one user, thus requiring two activity diagrams in the design process. The activity “Asking the QA System” as shown in Figure 4.3 begins when the user enters a question into the QA System. The QA System then generates a response based on relevant legal documents and presents the answer to the user. After receiving the answer, the user has the option to either ask another question or end the interaction. If the user chooses not to ask further questions, the activity ends.

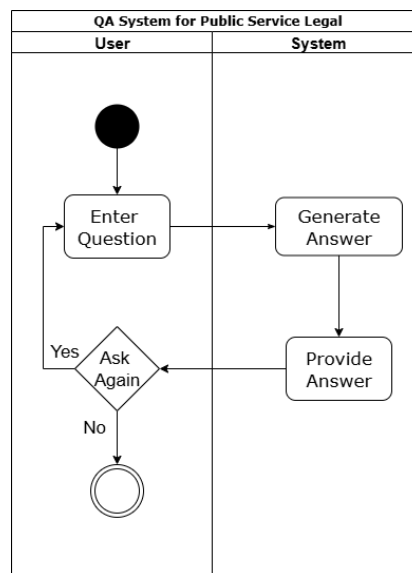


Figure 4.3 Activity Diagram “Ask to QA System”

In the activity “Responding to QA System Answers,” the user can respond directly to the QA System's answer as explain in Figure 4.4. This feature leverages the QA System’s memory capability, allowing it to understand follow-up questions without the user needing to restate the previous context. After receiving a follow-up response from the QA System, the user may choose to continue the conversation or end it. If no further responses are provided, the activity concludes.

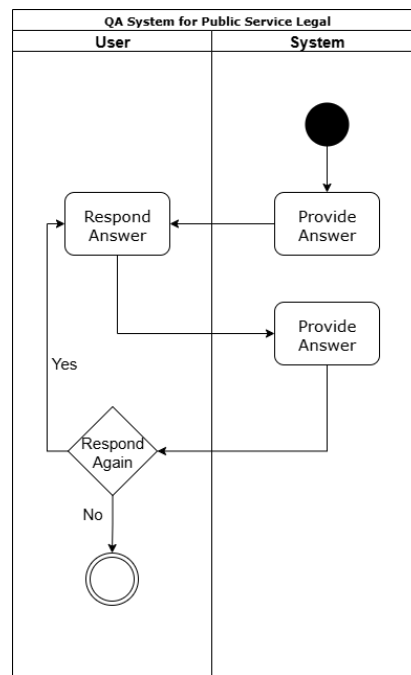


Figure 4.4 Activity Diagram “Respond to QA System’s Answer”

4.2.3 Interface

The interface design used in this QA System system is designed with a simple and intuitive approach to facilitate ease of interaction for users. The simplicity of design is chosen to ensure that users from various backgrounds, including those with limited understanding of technology, can still access and utilize the system optimally. A minimalist interface with clear navigation allows users to ask questions and receive answers without experiencing technical barriers. Additionally, the selection of functional and non-excessive visual elements aims to minimize distractions and increase focus on the content of conversations with the QA System. The implementation of this design is shown in Figure 4.5, which displays the overall interface layout of the system.

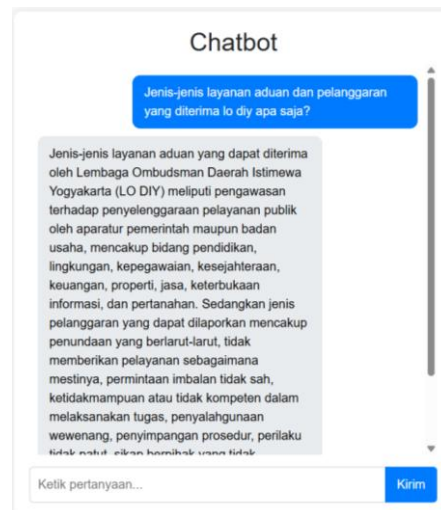


Figure 4.5 QA System Interface

This design process also includes the development of a front-end interface using HTML and CSS, aimed at ensuring a responsive and visually consistent user experience. The front end plays a critical role in enabling users to interact naturally with the QA System, especially when searching for legal information in a conversational format. The code explained in Figure 4.6., used to create the QA System interface applies standard HTML structure enhanced with Bootstrap for styling and responsiveness. The CSS section defines the visual layout, including message bubble styles, background colors for user and bot messages, input field appearance, and button styling. These definitions ensure a clean, user-friendly design that highlights the conversation flow while maintaining accessibility across devices.

```

<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1">
<title>Chatbot</title>

<!-- Bootstrap CSS -->
<link
href="https://cdn.jsdelivr.net/npm/bootstrap@5.0.2/dist/css/bootstrap.min.c
ss" rel="stylesheet" integrity="sha384-
EVSTQN3/azprG1Anm3QDgpJLIm9Nao0Yz1ztcQTWfSpd3yD65VohhpUuCOMLASjC"
crossorigin="anonymous">

<style>
  body { font-family: Arial, sans-serif; max-width: 600px; margin: 0
auto; padding: 20px; background-color: #f8f9fa; }
  .chat-container { background: #fff; padding: 20px; border-radius: 10px;
box-shadow: 0 0 10px rgba(0,0,0,0.1); }
  .chat-box { max-height: 500px; overflow-y: auto; padding: 10px; }
  .chat-bubble { padding: 10px 15px; border-radius: 10px; margin: 5px 0;
max-width: 75%; }
  .user { background-color: #007bff; color: white; align-self: flex-end;
}
  .bot { background-color: #e9ecef; color: black; align-self: flex-start;
}
  .input-group { margin-top: 15px; }
  .chat-input { flex: 1; padding: 10px; border: 1px solid #ccc; border-
radius: 5px; }
  .send-btn { background-color: #007bff; color: white; padding: 10px
15px; border: none; border-radius: 5px; cursor: pointer; }
</style>
</head>

<body>
<div class="chat-container">
  <h2 class="text-center">Chatbot</h2>
  <div id="chatBox" class="chat-box d-flex flex-column"></div>
  <div class="input-group">
    <input type="text" id="question" class="chat-input" placeholder="Ketik
pertanyaan..." required>
    <button id="sendBtn" class="send-btn">Kirim</button>
  </div>
</div>
...
</body>
</html>

```

Figure 4.6 Interface Code

4.3 Implementation

This section details the implementation of the Question Answering (QA) system developed for this research. The process begins with the data curation and data processing stages. Subsequently, it describes the implementation of the Retrieval-Augmented Generation (RAG) framework.

4.3.1 Data Aggregation and Curation

Detailed information about LO DIY, including reporting processes, legal foundations, and examples of principles applied in case handling, is required in the development of this QA System. This information was obtained through interviews conducted at the LO DIY as well as research from various books discussing the institution. From the 10 frequently asked public service topics, 3 key topics were selected as the main data sources for this system. Each of these three topics comprises several relevant data sources, as detailed in Table 4.1 in the Data Collected section. The selected data from these topics were compiled into a single text file and used to build the database for the QA System. After collecting the required information and data, the compiled content was converted into text files to be integrated with the developed model, enabling more accurate and relevant responses.

4.3.2 Document Processing in QA System System Implementation Result

The QA System is developed using LangChain with a Retrieval-Augmented Generation (RAG) system approach. In the QA System development, external documents are utilized to expand its knowledge coverage and improve response accuracy. This process consists of two main steps, including Document Processing with *RecursiveCharacterTextSplitter* and Vector Storage with *Chroma* as visualized in Figure 4.6.

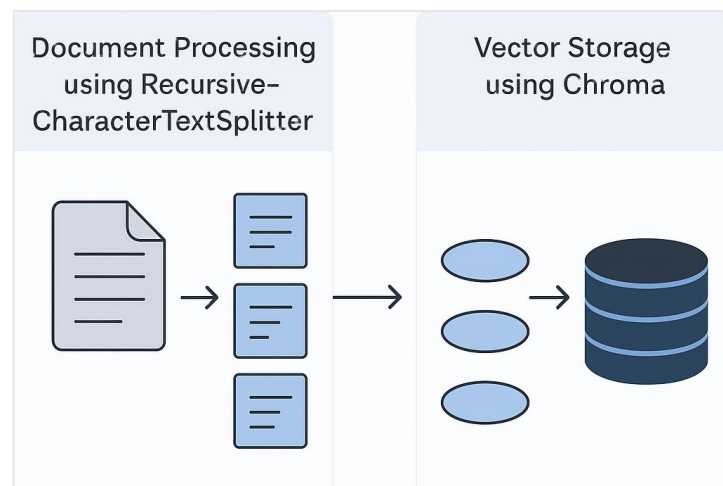


Figure 4.7 Document Processing

Document Processing Using RecursiveCharacterTextSplitte

In a QA System system that implements Retrieval-Augmented Generation (RAG), document processing is an important step to improve information retrieval accuracy. Large Language Models (LLM) have limitations in the amount of text that can be processed at one time (Meyer et al., 2023). In this research the method used was by dividing large documents into smaller, more manageable parts called chunks as explained in Figure 4.8. This process uses *RecursiveCharacterTextSplitter* to divide documents into several parts so they can be processed more efficiently by the QA System. If documents are too long, the model cannot analyze them optimally. Therefore, by dividing documents into smaller parts, the QA System can retrieve more relevant information without losing important context.

```
def __init__(self, config: ChatbotConfig):
    self.config = config
    self.text_splitter =
RecursiveCharacterTextSplitter.from_tiktoken_encoder(
    chunk_size=config.chunk_size,
    chunk_overlap=config.chunk_overlap
)
```

Figure 4.8 Document Processing Using RecursiveCharacterTextSplitte

Vector Storage Using Chroma

After documents are divided into several parts (chunks), the data is stored in a format that enables fast and efficient search. In this case, vector storage plays an important role. Instead of storing text in raw word form, each chunk is converted into numerical representations (embeddings), which capture the meaning of the text.

In this QA System system, Chroma is used as a vector database to store these embeddings as explained in Figure 4.9. The transformation from text to vectors is performed using OpenAIEmbeddings, which converts text into high-dimensional numerical representations. Embeddings enable the QA System to retrieve the most relevant information based on meaning, not merely direct word matching.

When users ask questions, the system will convert the question into a vector and search for the most similar vectors in Chroma. With this approach, the QA System can retrieve information that has semantic connections to the question, even when different words are used. This approach allows the QA System to provide more relevant and in-depth responses, thereby improving the overall user experience.

```
def create_vectorstore(self, documents: List[Document]) -> Chroma:
    """Buat vectorstore dari dokumen"""
    try:
        splits = self.text_splitter.split_documents(documents)
        return Chroma.from_documents(
            documents=splits,
            embedding=OpenAIEmbeddings()
        )
    except Exception as e:
        logger.error(f"Kesalahan membuat vector store: {str(e)}")
        raise HTTPException(status_code=500, detail="Terjadi kesalahan internal")
```

Figure 4.9 Vector Storage Using Chroma

4.3.3 Integration of Retrieval-Augmented Generation (RAG) Architecture in the QA System System

The following is an explanation of the Retrieval-Augmented Generation (RAG) implementation in the developed QA System. As illustrated in Figure 4.10, the process begins with Prompt Implementation, where user questions are refined using a ChatPromptTemplate and linked to Chroma Vector Storage for document retrieval. The Information Retrieval Process retrieves relevant context using `retrieve.map()` and eliminates duplicate documents through `get_unique_union`. The filtered results are then passed to the RAG Chain, which incorporates domain-specific context and previous chat history to generate informed responses. Finally, the QA System Response Generation stage delivers the answer and updates the conversation memory with both user and AI messages, enabling contextual continuity in future interactions. Each of these components and their roles in the RAG-based QA System will be explained in more detail in the following subsections.

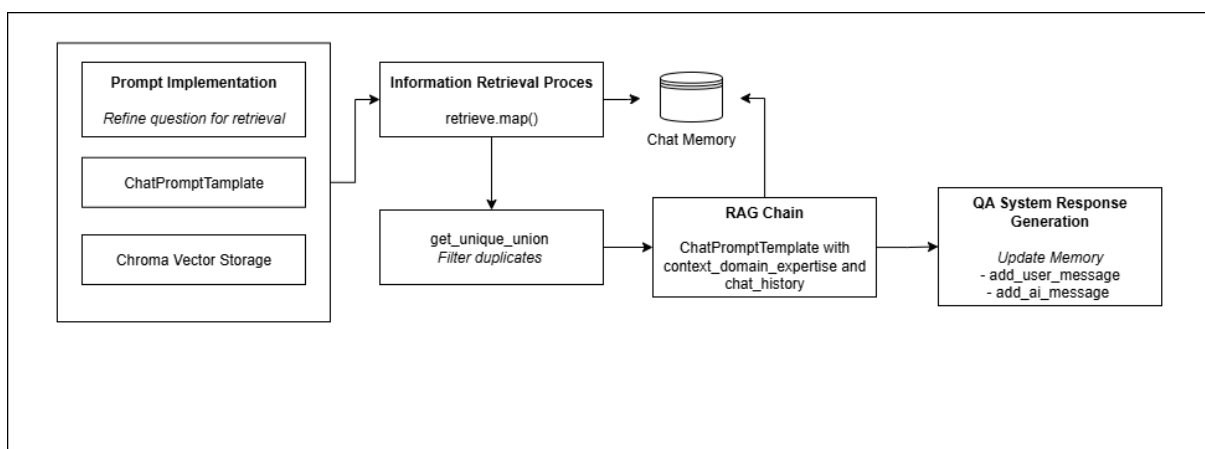


Figure 4.10 RAG Flow

Prompt Implementation Using ChatPromptTemplate

Prompts play an important role in shaping how language models respond by structuring inputs to generate relevant and contextually appropriate answers. In LangChain, ChatPromptTemplate helps define and format prompts systematically, making it easier to control QA System behavior dynamically. This is particularly important in RAG-based QA Systems, where responses must combine retrieved knowledge before being generated.

As explained in Figure 4.11, ChatPromptTemplate is utilized in two main stages: question generation and final response generation. The first prompt template is designed to establish the QA System's role, integrate expertise in public law, and provide clear instructions regarding response structure. This approach ensures that the QA System provides consistent, clear, and informative answers.

Another ChatPromptTemplate is used in the final response generation stage. This template combines context retrieved from documents with user questions, ensuring that the provided answers are relevant, fact-based, and well-supported. By structuring prompts systematically, the QA System can reduce the risk of providing inaccurate information while maintaining reliability in legal applications. Additionally, structured prompts help maintain consistency in QA System responses, making it more reliable and user-friendly.

```

template_rag = """
    Berdasarkan konteks berikut ini, jawablah pertanyaan dengan
    mengikuti panduan yang telah ditetapkan:

    Konteks:
    {context}

    Domain Keahlian: {domain_expertise}

    Riwayat Percakapan:
    {chat_history}

    Pertanyaan Terbaru: {question}

    Berikan jawaban yang mempertimbangkan riwayat percakapan untuk
    memastikan respons yang koheren dan relevan dengan konteks percakapan
    sebelumnya.
    """

prompt = ChatPromptTemplate.from_template(template_rag)
llm = ChatOpenAI(temperature=self.config.final_temperature)

self.final_chain = (
    {
        "context": self.retrieval_chain,
        "question": itemgetter("question"),
        "domain_expertise": lambda x: self.config.domain_expertise,
        "chat_history": lambda x: self.get_chat_history(),
    }
    | prompt
    | llm
    | StrOutputParser()
)

```

Figure 4.11 Prompt Implementation Using ChatPromptTemplate

template_rag is used as a framework for structuring QA System answers based on information found in related documents, making the generated responses more contextual. Conversation history ({chat_history}) plays a role in helping the QA System recognize and understand previous interactions, ensuring that answers remain consistent with the discussion flow. Meanwhile, *final_chain* functions to connect the retrieval chain with prompts and the GPT-4 model, enabling the QA System to provide more comprehensive and context-based responses.

Information Retrieval Process

The *retrieval_chain* property defines the mechanism through which the QA System performs information retrieval based on user input. This function is composed of three main components: *generate_queries*, *retriever.map()*, and *get_unique_union*, each of which

contributes to ensuring that the retrieval process is both relevant and efficient as explained in Figure 4.12.

```
@property
def retrieval_chain(self):
    return self.generate_queries | self.retriever.map() |
        self.get_unique_union
```

Figure 4.12 Information Retrieval Process

The `generate_queries` method is responsible for formulating refined search queries derived from the user's original question. By transforming the natural language input into structured queries that better align with the vector representation of documents, this function enhances the accuracy and specificity of the retrieval process. This step is critical, particularly in specialized domains such as legal information systems, where precision in query formulation directly impacts the relevance of the results.

The `retriever.map()` function serves as the core retrieval mechanism. It maps the generated queries to the vector database and identifies documents that are semantically similar. This ensures that the retrieved documents are not only lexically but also contextually relevant to the user's intent. The use of semantic search enables the system to go beyond keyword matching, leveraging embeddings to understand the meaning behind the query.

Finally, the `get_unique_union` function ensures the integrity and quality of the retrieved data. It filters out duplicate results and consolidates overlapping information, thereby providing the user with a clean, non-redundant, and coherent set of documents. This post-processing step is essential for maintaining clarity in the QA System's responses and preventing confusion due to repeated or conflicting information.

RAG Chain

The RAG chain is a core component in this system architecture as explained in Figure 4.13. It is enabling the combination of external knowledge retrieval and generative response capabilities. The *ChatPromptTemplate* plays a crucial role in structuring the prompts used in the interaction process. It is specifically designed to align with the QA System's domain of expertise, ensuring that the formulated search queries are contextually relevant and semantically accurate. This customization enhances the retrieval performance by directing the system to retrieve information that is more aligned with the users' intent and the legal or regulatory domain of the QA System.

In addition to that, the use of a detailed prompt template “Konteks Tambahan”, as illustrated in Figure 4.13, is essential to guide the system in generating responses that are consistent with the intended objectives of the QA System. Without a structured and specific template, the system’s responses tend to be less coherent, incomplete, or not aligned with the desired communication style. For example, the model might provide overly brief answers, repeat information unnecessarily, or ignore to include contextual explanations and references. By defining explicit instructions such as the use of formal yet simple language, the inclusion of warm greetings, the provision of detailed and concrete answers, and the citation of specific sources when available, the system is directed to produce outputs that are not only accurate but also user-friendly and contextually meaningful.

This detailed template also plays a significant role in differentiating the system’s behavior depending on the type of user input. For instance, when the input is not a question but rather a statement or expression of gratitude, the system is instructed to respond politely, acknowledge the input warmly, and encourage further engagement. On the other hand, when the input is a question, the system is guided to deliver accurate answers, enriched with supporting context, and supplemented with references. Therefore, the inclusion of this template ensures that the QA System can deliver responses that meet both the technical accuracy required in the legal domain and the communication standards expected by users, resulting in outputs that are more reliable, structured, and aligned with user needs.

Furthermore, the *ChatOpenAI(temperature=self.config.temperature)* component utilizes the GPT-4 model with a predefined temperature parameter. This parameter controls the randomness or determinism of the QA System's responses. A lower temperature results in more focused and deterministic outputs, which is suitable for domains that require precision, such as legal or policy-related inquiries. Conversely, a higher temperature allows for more creative responses, which can be useful in exploratory or advisory contexts. By configuring this temperature setting appropriately, the system is able to balance accuracy and flexibility according to the specific requirements of the conversation, thereby enhancing the overall responsiveness and reliability of the QA System.

```

def setup_chains(self):
    """Set up the RAG chains for retrieval and generation."""
    # Primary template for generating queries
    template = """Anda adalah asisten AI yang berfokus pada
{domain_expertise}.
Konteks tambahan: {context}

Instruksi spesifik:
1. Gunakan bahasa yang formal namun mudah dipahami
2. Berikan awalan kalimat dan penutup kalimat yang hangat menyapa
3. Berikan jawaban yang detail
4. Berikan contoh konkret jika relevan
5. Rujuk sumber spesifik dari data jika tersedia
6. Beri tahu jika jawaban tidak dapat ditemukan dalam konteks
7. Setiap jawaban beri pertanyaan lanjutan

Penting: Pastikan untuk memberikan informasi yang tidak berulang
dari satu respons. Jangan mengulang informasi yang sudah diberikan
sebelumnya.

Jika input dari pengguna bukan pertanyaan (misalnya, pernyataan,
ucapan terima kasih, atau pengakuan):
- Tanggapi dengan hangat
- Tanyakan apakah pengguna memiliki pertanyaan lain
- Akhiri dengan komentar yang sopan

Jika input dari pengguna adalah pertanyaan:
- Jawab dengan akurat
- Berikan konteks yang membantu jika diperlukan
- Rujuk ke sumber spesifik jika tersedia
"""

    prompt_perspectives = ChatPromptTemplate.from_template(template)

    # Bind the template with configuration
    self.generate_queries = (
        prompt_perspectives
        | ChatOpenAI(temperature=self.config.temperature)
        | StrOutputParser()
        | (lambda x: x.split("\n")))

```

Figure 4.13 RAGChain Class

RAGChain Class for Managing RAG

In the system development it's utilized the RAGChain class as explained in Figure 4.14. In RAGChain class the *vectorstore.as_retriever()* function is used to retrieve the retriever object from the Chroma vector database, which functions to search for embedding-based information, enabling the QA System to find more relevant answers based on semantic similarity. Meanwhile, *ConversationBufferMemory* is used to store conversation history, allowing the QA System to maintain context in ongoing interactions, so it can provide answers that are more aligned with the previous conversation flow.

```

class RAGChain:
    def __init__(self, vectorstore: Chroma, config: ChatbotConfig):
        self.config = config
        self.retriever = vectorstore.as_retriever()
        # Initialize memory
        self.memory = ConversationBufferMemory(
            memory_key="chat_history",
            return_messages=True
        )
        self.setup_chains()

```

Figure 4.14 RAGChain Class

Chat Memory

In this system development chat memory utilized so QA System can remember previous conversation using `get_chat_history` as explained Figure 4.15. The `get_chat_history` function plays a vital role in enabling contextual continuity within the QA System system. This function is responsible for retrieving and formatting the history of previous interactions between the user and the QA System, allowing the model to maintain awareness of the ongoing conversation.

```

def get_chat_history(self) -> str:
    """Format chat history for inclusion in the prompt."""
    messages = self.memory.chat_memory.messages
    if not messages:
        return "Tidak ada riwayat percakapan sebelumnya."

    formatted_history = ""
    for i in range(0, len(messages), 2):
        if i + 1 < len(messages):
            formatted_history += f"Pengguna: {messages[i].content}\n"
            formatted_history += f"AI: {messages[i+1].content}\n\n"

    return formatted_history

```

Figure 4.15 Chat Memory

By accessing `self.memory.chat_memory.messages`, the function captures the dialogue history stored in memory, which consists of alternating user and AI messages. If no previous messages are detected, a default message ("Tidak ada riwayat percakapan sebelumnya") is returned, indicating that the session is either new or the memory has been cleared. The implementation includes a loop that processes the message pairs in order, assuming a user message is followed by an AI response. Each interaction is then formatted and appended to the `formatted_history` string using a human-readable structure (e.g., "Pengguna: ..." and "AI: ..."). This structured formatting is particularly important for inclusion in prompts when generating

responses using a large language model, as it allows the model to recognize the flow and context of the conversation.

Preserving chat history enhances the QA System's ability to produce coherent, contextually relevant responses, especially in multi-turn dialogues where the user's intent may rely on previous exchanges. This capability is essential in domains such as legal information services, where precise understanding of prior context is critical for generating accurate and reliable responses. Ultimately, the chat memory mechanism contributes to a more natural, human-like interaction experience by ensuring that each response is informed by what has already been communicated in the conversation.

QA System Response Generation

In this study, the `generate_response` function plays a central role in producing QA System replies, as illustrated in Figure 4.16. When a user submits a question, the system invokes the `final_chain`, which integrates the query, domain expertise, and additional context to retrieve relevant documents and generate a coherent response. After the response is generated, the system updates the chat memory with both the user input and the AI reply, ensuring contextual consistency in multi-turn conversations. This mechanism allows the QA System to maintain continuity and relevance throughout the dialogue. Additionally, if an error occurs during the process, the function returns a predefined error message to ensure a smooth user experience.

```

def generate_response(self, question: str) -> str:
    """Generate a response for the given question and update memory."""
    try:
        response = self.final_chain.invoke({
            "question": question,
            "context": self.config.additional_context,
            "domain_expertise": self.config.domain_expertise
        })

        # Update memory with the new interaction
        self.memory.chat_memory.add_user_message(question)
        self.memory.chat_memory.add_ai_message(response)

        return response
    except Exception as e:
        logger.error(f"Error generating response: {str(e)}")
        return "Mohon maaf, terjadi kesalahan dalam memproses pertanyaan Anda. Silakan coba lagi."

```

Figure 4.16 QA System Response Generation

4.3.4 Integration and Initial Evaluation of the System

At this stage, integration is performed among all system components, including natural language processing modules, information retrieval mechanisms, the knowledge base, and the previously designed user interface. After integration, initial testing is conducted by submitting a series of questions to the QA System. The detail explanation is provided as follows.

System Integration

At this stage, the QA System system based on the Retrieval-Augmented Generation (RAG) approach has been successfully integrated into a web interface using a combination of FastAPI for the backend and JavaScript for the frontend as explained in Figure 4.17. and Figure 4.18. The backend provides endpoints to receive user questions in both JSON and Form formats via the */chat* and */chat-form* routes, which are then processed using the *get_response()* method from the *chatbot_instance* object. Meanwhile, the frontend handles user input through a form element and sends it using the *fetch()* function to the backend endpoint. The QA System's response is displayed directly in the conversation interface, and error handling has been implemented on both the client and server sides to ensure system reliability.

```

@app.post("/chat", response_model=ChatResponse)
def chat(request: ChatRequest):
    """Endpoint to ask chatbot questions via JSON"""
    try:
        response = chatbot_instance.get_response(request.question)
        return ChatResponse(answer=response)
    except Exception as e:
        logger.error(f"Error: {str(e)}")
        raise HTTPException(status_code=500, detail="Error processing your
question")

@app.post("/chat-form", response_model=ChatResponse)
def chat_form(form_data: dict = Depends(get_chat_form_data)):
    """Endpoint to ask chatbot questions via Form"""
    try:
        response = chatbot_instance.get_response(form_data["question"])
        return ChatResponse(answer=response)
    except Exception as e:
        logger.error(f"Error: {str(e)}")
        raise HTTPException(status_code=500, detail="Error processing your
question")

@app.get("/", response_class=FileResponse)
def read_root():
    """Root endpoint that serves chatbot HTML page"""
    return "static/index.html"

```

Figure 4.17 FastAPI Code

```

<script>
    document.getElementById('sendBtn').addEventListener('click', async
function() {
    const inputField = document.getElementById('question');
    const question = inputField.value.trim();
    if (!question) return;

    addMessage(question, 'user');
    inputField.value = '';

    const formData = new FormData();
    formData.append('question', question);

    try {
        const response = await fetch('/chat-form', {
            method: 'POST',
            body: formData
        });

        const data = await response.json();
        addMessage(data.answer, 'bot');
    } catch (error) {
        addMessage('Terjadi kesalahan saat memproses pertanyaan
Anda.', 'bot');
    }
    });

    function addMessage(text, sender) {
        const chatBox = document.getElementById('chatBox');
        const messageDiv = document.createElement('div');
        messageDiv.classList.add('chat-bubble', sender);
        messageDiv.textContent = text;
        chatBox.appendChild(messageDiv);
        chatBox.scrollTop = chatBox.scrollHeight;
    }
}
</script>

```

Figure 4.18 Script Code

This integration enables users to interact with the QA System in real-time through an HTML page served by the root endpoint (/). Initial evaluations indicate that the system is capable of responding to user queries effectively and delivering a smooth user experience. This stage serves as the foundation for further expert-based testing described in the following section.

System Initial Evaluation

The initial testing phase is carried out by submitting a set of questions to the QA System. This stage examines the system's capability to deliver precise, relevant, and context-appropriate answers. In addition, it evaluates the interface and user interaction to ensure that the visual layout and functionality correspond to the initial design and remain user-friendly.

The prompting process also includes repeated testing, where questions are iteratively refined and re-examined to guarantee that the system's responses consistently align with the expected accuracy and relevance. The initial process of prompting, as illustrated in Figure 4.19, shows that the responses generated at this stage remain brief and fairly general.

```
PS C:\Users\hp\tchbt> python test.py
C:\Users\hp\tchbt\test.py:22: LangChainDeprecationWarning: Please see the migration guide at: https://python.langchain.com/docs/versions/migrating_memory/
  memory = ConversationBufferMemory(
C:\Users\hp\tchbt\test.py:37: LangChainDeprecationWarning: The class `LLMChain` was deprecated in LangChain 0.1.17 and will be removed in 1.0. Use :meth:`~RunnableSequence`, e.g.,
  , `prompt | llm` instead.
  ombudsman_chain = LLMChain(llm=chat, prompt=ombudsman_prompt, memory=memory)
>> apa itu lo diy?
C:\Users\hp\tchbt\test.py:47: LangChainDeprecationWarning: The method `Chain.run` was deprecated in langchain 0.1.0 and will be removed in 1.0. Use :meth:`~invoke` instead.
  result = ombudsman_chain.run({"content": content})
Lembaga Ombudsman (LO) adalah Lembaga independen yang bertugas untuk mengawasi pelayanan publik dan menyelesaikan keluhan masyarakat terkait dengan penyelenggaraan pelayanan publ
ik. LO biasanya berperan sebagai mediator antara pihak yang mengeluh dengan pihak yang dikeluhkan, serta memberikan rekomendasi atau saran untuk meningkatkan kinerja lembaga yang
bersangkutan.
>> █
```

Figure 4.19 Initial Testing Result

Subsequently, after the prompt template was updated with more detailed instructions, the system produced responses that were more comprehensive and aligned with expectations, as illustrated in Figure 4.20. At this stage, the prompt generated answers enriched with additional information beyond the initial response. Although the questions posed differed from those in the initial process, the results provided were more accurate, relevant, and complete.

```
PS C:\Users\hp\lchbt> python main.py
[12/30/24 09:14:33] INFO Anonymized telemetry enabled. See https://docs.trychroma.com/telemetry for more information.
[12/30/24 09:14:35] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"
AI Assistant untuk hukum pelayanan publik dan ombudsman siap membantu Anda. Ketik 'exit' untuk keluar.

Silakan ajukan pertanyaan Anda: Jenis-jenis layanan aduan dan pelanggaran yang di terima lo diy apa saja?

Respond AI:
[12/30/24 09:14:48] INFO HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK"
[12/30/24 09:14:49] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"
[12/30/24 09:14:50] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"
[12/30/24 09:14:51] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"
C:\Users\hp\lchbt\main.py:145: LangChainBetaWarning: The function `loads` is in beta. It is actively being worked on, so the API may change.
  return [loads(doc) for doc in unique_docs]
[12/30/24 09:14:53] INFO HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK"
Jenis layanan aduan yang dapat diterima oleh Lembaga Ombudsman Daerah Istimewa Yogyakarta (LO DIY) meliputi pengawasan terhadap penyelenggaraan pelayanan publik oleh aparatur
pemerintah maupun badan usaha. Sedangkan jenis pelanggaran yang dapat dilaporkan mencakup:
1. Penundaan yang berlarut-larut
2. Tidak memberikan pelayanan sebagaimana mestinya
3. Permintaan imbalan tidak sah
4. Ketidakhadiran atau tidak kompeten dalam melaksanakan tugas
5. Penyalahgunaan wewenang
6. Penyimpangan prosedur
7. Perilaku tidak patut
8. Sikap berpihak yang tidak seharusnya
9. Konflik kepentingan
10. Pelanggaran etika usaha
11. Diskriminasi
12. Ketidaktransparanan
13. Ketidakakuntabelan

Penyampaian pengaduan ini bertujuan untuk meningkatkan kualitas pelayanan publik dan menjamin keadilan dalam tata kelola pemerintahan serta badan usaha.

Silakan ajukan pertanyaan Anda: exit
Terima kasih telah menggunakan layanan kami. Sampai jumpa!
PS C:\Users\hp\lchbt> █
```

Figure 4.20 Updated Testing Result

4.4 Evaluation

In the evaluation stage, the QA System's performance was tested to assess the accuracy, relevance, and effectiveness of its responses.

4.4.1 Expert Evaluation

This evaluation involved system testing as well as validation by public law experts. The testing stage was carried out through descriptive analysis using a questionnaire as the evaluation medium. After the QA System application was developed, testing was conducted by gathering feedback from experts on the completed application. This testing involved five experts from Lembaga Ombudsman Daerah Istimewa Yogyakarta. The testing process compared the results of the integrated system with Retrieval-Augmented Generation (RAG), and one without RAG. The QA System was prompted with several questions, and the responses from both systems were compared side by side. The questions posed to the QA System were categorized into three main themes:

a. Service Complaint Procedures

This set of questions was designed to evaluate the QA System's ability to explain fundamental and procedural information specific to LO DIY, such as the types of complaint services, the report handling workflow, and the definitions of crucial stages like clarification and investigation. The results as shown in Table 4.2., it shows a clear distinction: the QA System without RAG provided general and conceptual answers, while the QA System with RAG was able to present highly specific and contextual information. QA System with RAG used accurate internal LO DIY terminology, such as the "Konsultasi dan penerimaan laporan" stage and detailed the specific types of violations handled. This demonstrates that RAG successfully extracted and presented specific operational knowledge from its database, surpassing generic responses.

Table 4.2. Service Complaint Procedures Result

Questions	Non-RAG QA System Answer	RAG QA System Answer
Apa saja alur yang dilewati saat penanganan kasus/ laporan di LO DIY?	Proses penanganan kasus atau laporan di Lembaga Ombudsman Daerah Istimewa Yogyakarta (LO DIY) meliputi beberapa langkah sebagai berikut:	Alur penanganan kasus/ laporan di LO DIY terdiri dari: 1. Konsultasi dan penerimaan laporan:

	<p>1. Penerimaan Laporan: Laporan dari masyarakat dapat diterima melalui berbagai cara, seperti melalui telepon, surat, email, atau langsung datang ke kantor LO DIY.</p> <p>2. Pemeriksaan Awal: Setelah menerima laporan, pihak LO DIY akan melakukan pemeriksaan awal terhadap laporan untuk menentukan apakah laporan tersebut memenuhi syarat untuk dilanjutkan ke tahap selanjutnya.</p> <p>3. Penelitian dan Analisis: Jika laporan memenuhi syarat, LO DIY akan melakukan penelitian dan analisis untuk mengumpulkan informasi dan bukti yang diperlukan terkait dengan kasus tersebut.</p> <p>4. Mediasi: LO DIY dapat mencoba untuk melakukan mediasi antara pihak yang melapor dengan pihak yang dilaporkan guna mencari solusi yang dapat diterima oleh kedua belah pihak.</p> <p>5. Penyusunan Rekomendasi: Setelah melakukan penelitian dan mediasi, LO DIY akan menyusun rekomendasi yang berisi saran atau rekomendasi terkait penyelesaian kasus yang telah ditangani.</p> <p>6. Pengumuman Keputusan: Rekomendasi yang telah disusun akan diumumkan kepada pihak yang terlibat dalam kasus tersebut, serta dapat dijadikan sebagai dasar untuk mengambil tindakan lebih lanjut.</p> <p>7. Pelaporan Hasil: LO DIY akan melaporkan hasil penanganan kasus kepada pihak terkait, termasuk masyarakat yang melaporkan kasus tersebut, sebagai bentuk akuntabilitas dan transparansi dari proses penanganan kasus yang dilakukan.</p> <p>Itulah beberapa alur yang biasanya dilewati saat penanganan kasus atau laporan di LO DIY. Diharapkan proses ini dapat memberikan keadilan dan</p>	<p>- Tahap awal dalam pelayanan di LO DIY.</p> <p>- Pelapor dapat melakukan konsultasi dan melaporkan permasalahan terkait pelayanan publik.</p> <p>- Pelapor diminta untuk mengisi form konsultasi atau form laporan.</p> <p>- Penerima laporan akan menjelaskan tugas dan kewenangan LO DIY, mendengarkan, mencatat, dan menggali informasi dari Pelapor, menilai materi laporan, dan meminta Pelapor melengkapi syarat-syarat jika masalah masuk dalam kewenangan LO DIY.</p> <p>- Jika masalah tidak masuk dalam kewenangan LO DIY, penerima laporan akan memberikan saran atau merujuk ke lembaga yang kompeten.</p> <p>2. Klarifikasi:</p> <p>- Tahap untuk mendengarkan penjelasan dari Terlapor dan pihak terkait.</p> <p>- LO DIY mengirimkan surat undangan klarifikasi kepada Terlapor.</p> <p>- Klarifikasi dilakukan dengan mengundang Terlapor secara resmi/tertulis.</p> <p>- Jika Terlapor tidak merespon undangan klarifikasi, keterangan Pelapor dianggap benar.</p> <p>- LO DIY dapat meminta penjelasan dari pihak terkait untuk memperjelas posisi kasus.</p> <p>- Jika informasi yang terkumpul belum mencukupi, dapat dilakukan investigasi.</p> <p>3. Mediasi:</p> <p>- LO DIY melakukan mediasi untuk menyelesaikan masalah yang berkaitan dengan penyelenggaraan usaha yang beretika.</p> <p>- Mediasi dilakukan melalui musyawarah yang ditengahi oleh mediator netral.</p> <p>- Mediator adalah anggota komisioner LO DIY.</p> <p>- Kasus-kasus yang dapat dimediasi antara lain terkait dengan pelanggaran etika usaha, sengketa</p>
--	--	---

	<p>kepuasan bagi masyarakat yang menggunakan jasa lembaga ombudsman tersebut.</p>	<p>yang sebelumnya gagal diselesaikan, dan bukan sengketa yang sedang dimediasi oleh instansi lain yang berwenang.</p> <p>4. Investigasi:</p> <ul style="list-style-type: none"> - Dilakukan jika informasi yang terkumpul dari klarifikasi belum mencukupi. - LO DIY akan melakukan investigasi lebih lanjut untuk mengumpulkan fakta-fakta terkait kasus. <p>5. Pemberian Rekomendasi:</p> <ul style="list-style-type: none"> - Setelah melalui tahap-tahap sebelumnya, LO DIY akan memberikan rekomendasi sebagai hasil penanganan kasus/ laporan. - Rekomendasi yang dikeluarkan oleh LO DIY adalah dokumen publik dan akan ditembuskan ke pihak-pihak terkait.
<p>Apa saja ketentuan, pembatasan dan larangan dalam melakukan investigasi?</p>	<p>Dalam melakukan investigasi sebagai lembaga ombudsman, terdapat beberapa ketentuan, pembatasan, dan larangan yang perlu diperhatikan, antara lain:</p> <p>1. Ketentuan:</p> <ul style="list-style-type: none"> - Memiliki wewenang untuk mengakses dokumen dan informasi yang relevan untuk investigasi. - Menyelenggarakan investigasi secara independen dan obyektif. - Memberikan kesempatan kepada pihak yang bersangkutan untuk memberikan klarifikasi atau pembelaan. - Mengumpulkan bukti dan informasi secara teliti dan akurat. <p>2. Pembatasan:</p> <ul style="list-style-type: none"> - Tidak boleh melanggar hak asasi manusia dalam melakukan investigasi. - Tidak boleh melakukan investigasi terhadap kasus yang sedang dalam proses hukum. - Tidak boleh menggunakan informasi yang diperoleh secara tidak sah dalam investigasi. 	<p>Dalam melakukan investigasi, terdapat beberapa ketentuan, pembatasan, dan larangan yang harus diperhatikan, antara lain:</p> <p>1. Ketentuan:</p> <ul style="list-style-type: none"> - Investigasi dilakukan berdasarkan kewenangan LO DIY terkait pengawasan terhadap penyelenggaraan pelayanan publik oleh aparatur pemerintah maupun badan usaha. - Investigasi dilakukan secara objektif, transparan, dan independen. - Investigasi dilakukan dengan mengumpulkan bukti-bukti yang relevan dan valid. - Investigasi dilakukan dengan menghormati hak-hak semua pihak yang terlibat. <p>2. Pembatasan:</p> <ul style="list-style-type: none"> - Investigasi hanya dilakukan terhadap kasus-kasus yang masuk dalam lingkup kewenangan LO DIY. - Investigasi tidak boleh melanggar hak-hak individu yang terlibat dalam kasus yang sedang diselidiki. - Investigasi harus dilakukan sesuai

	<p>3. Larangan:</p> <ul style="list-style-type: none"> - Tidak boleh melakukan investigasi tanpa dasar hukum yang jelas. - Tidak boleh menggunakan informasi yang diperoleh dalam investigasi untuk kepentingan pribadi atau kelompok. - Tidak boleh memberikan informasi yang tidak benar atau menyesatkan dalam laporan investigasi. <p>Dengan mematuhi ketentuan, pembatasan, dan larangan tersebut, lembaga ombudsman dapat menjalankan tugasnya secara profesional dan berkualitas.</p>	<p>dengan prosedur dan mekanisme yang telah ditetapkan.</p> <p>3. Larangan:</p> <ul style="list-style-type: none"> - Tidak boleh melakukan investigasi tanpa dasar hukum yang jelas. - Tidak boleh melakukan investigasi yang bersifat diskriminatif atau merugikan pihak tertentu. - Tidak boleh melakukan investigasi yang melanggar etika dan norma hukum yang berlaku. <p>Dengan mematuhi ketentuan, pembatasan, dan larangan tersebut, LO DIY dapat menjalankan fungsi investigasi secara profesional dan bertanggung jawab.</p>
--	---	--

b. Knowledge Related to Business Processes and Public Services

This set of questions was designed to evaluate the QA System's ability to explain both theoretical concepts, such as business ethics, and information based on specific laws and regulations, such as the rights and obligations of various parties as explained in Table 4.3. The evaluation revealed that while both QA Systems provided comparable definitions for general concepts of business ethics, a significant difference appeared when asked about business principles. The QA System without RAG offered a generic list including principles like social responsibility and transparency. In contrast, the RAG-enabled QA System presented a more formal and structured list, including the "Prinsip Ketaatan Hukum", "Prinsip Akuntabilitas", "Prinsip Kewajaran", dan "Prinsip Empati". This superiority became even more dominant when testing legally-based knowledge. The non-RAG QA System could only provide normative, general answers regarding the rights and obligations of public organizers, business actors, and consumers. Conversely, the RAG-enabled QA System consistently delivered precise answers by directly referencing primary legal sources, citing Law No. 25 of 2009 concerning Public Services for the rights of public organizers and Law No. 8 of 1999 concerning Consumer Protection for the rights of business actors and consumers. This demonstrates RAG's capability to transform the QA System from a general-knowledge engine into an accurate and accountable information tool, capable of adopting formal taxonomies and citing specific legal frameworks.

Table 4.3. Business Processes and Public Services Result

Questions	Non-RAG QA System Answer	RAG QA System Answer
Jelaskan apa yang dimaksud etika bisnis?	Etika bisnis adalah seperangkat prinsip moral dan nilai-nilai yang mengatur perilaku dan keputusan yang diambil dalam konteks dunia bisnis. Etika bisnis menekankan pentingnya integritas, kejujuran, tanggung jawab sosial, dan ketaatan terhadap hukum dalam setiap tindakan yang dilakukan oleh individu atau organisasi dalam lingkungan bisnis. Hal ini juga mencakup aspek-aspek seperti perlakuan adil terhadap karyawan, pelanggan, dan mitra bisnis, serta keberlanjutan lingkungan dan dampak sosial dari keputusan bisnis yang diambil. Etika bisnis adalah landasan yang penting untuk menciptakan hubungan bisnis yang sehat, berkelanjutan, dan berorientasi pada kebaikan bersama.	Etika bisnis adalah seperangkat prinsip moral dan nilai-nilai yang mengatur perilaku dan tindakan dalam dunia bisnis. Etika bisnis menekankan pentingnya integritas, kejujuran, tanggung jawab sosial, dan keadilan dalam setiap keputusan dan tindakan yang diambil oleh pelaku bisnis. Hal ini bertujuan untuk memastikan bahwa bisnis beroperasi dengan cara yang sesuai dengan norma-norma moral dan hukum yang berlaku, serta memberikan kontribusi positif bagi masyarakat dan lingkungan sekitar. Etika bisnis juga melibatkan pertimbangan terhadap dampak sosial, lingkungan, dan ekonomi dari setiap keputusan bisnis yang diambil.
Apa saja prinsip prinsip bisnis yang harus diterapkan oleh badan usaha swasta (perusahaan)?	Ada beberapa prinsip bisnis beretika berkelanjutan yang harus diterapkan oleh badan usaha swasta (perusahaan), antara lain: 1. Tanggung jawab sosial: Perusahaan harus mempertimbangkan dampak dari keputusan bisnis mereka terhadap masyarakat dan lingkungan sekitar. Mereka harus bertanggung jawab atas keberlanjutan sosial dan lingkungan. 2. Transparansi: Perusahaan harus transparan dalam menjalankan bisnis mereka, termasuk dalam hal keuangan, kebijakan, dan praktik bisnis. Transparansi membantu membangun kepercayaan dengan para pemangku kepentingan. 3. Kepatuhan terhadap hukum dan peraturan: Perusahaan harus mematuhi semua hukum dan peraturan yang berlaku dalam menjalankan bisnis mereka. Hal ini termasuk dalam hal perlindungan lingkungan, hak asasi manusia, dan perlakuan yang adil terhadap karyawan. 4. Pengelolaan risiko: Perusahaan	Prinsip-prinsip bisnis beretika berkelanjutan yang harus diterapkan oleh badan usaha swasta (perusahaan) adalah sebagai berikut: 1. Prinsip Ketaatan Hukum: Badan usaha swasta harus taat pada aturan hukum yang berlaku, baik itu undang-undang maupun peraturan lainnya. Hal ini mencakup kesepakatan atau perjanjian yang dibuat oleh para pihak. Dengan menerapkan prinsip ketaatan hukum, diharapkan badan usaha dapat menciptakan keteraturan, menghindari penyimpangan, dan mengurangi dampak negatif yang ditimbulkan. 2. Prinsip Transparansi: Badan usaha swasta harus bersedia untuk melakukan keterbukaan dalam proses pengambilan keputusan dan memberikan informasi yang relevan kepada stakeholder dan shareholder. Transparansi ini mencakup informasi mengenai jasa, produk, kebijakan,

	<p>harus mengelola risiko secara proaktif, termasuk risiko lingkungan, sosial, dan tata kelola perusahaan. Mereka harus memiliki kebijakan dan prosedur yang memastikan risiko-risiko ini dikelola dengan baik.</p> <p>5. Keterlibatan pemangku kepentingan: Perusahaan harus berkomunikasi dan berinteraksi dengan semua pemangku kepentingan mereka, termasuk karyawan, pelanggan, pemasok, dan masyarakat setempat. Keterlibatan ini membantu memastikan bahwa keputusan bisnis yang diambil memperhitungkan kepentingan semua pihak terkait.</p> <p>Dengan menerapkan prinsip-prinsip ini, perusahaan dapat menjalankan bisnis mereka secara berkelanjutan dan beretika, serta memberikan dampak positif bagi masyarakat dan lingkungan sekitar.</p>	<p>dan segala hal yang berhubungan dengan perusahaan. Dengan menerapkan prinsip transparansi, diharapkan badan usaha dapat membangun kepercayaan dari pihak terkait.</p> <p>3. Prinsip Akuntabilitas: Badan usaha swasta harus memiliki kejelasan fungsi, pelaksanaan, dan pertanggungjawaban manajemen perusahaan. Hal ini berarti bahwa perusahaan harus dapat bertanggung jawab secara efektif dan efisien dalam menjalankan operasionalnya. Standar Operasional Prosedur (SOP) dapat menjadi salah satu cara untuk mengukur tingkat akuntabilitas perusahaan.</p> <p>4. Prinsip Pertanggungjawaban: Badan usaha swasta harus siap untuk bertanggung jawab atas segala tindakan dan keputusan yang diambil dalam menjalankan bisnisnya. Pertanggungjawaban ini mencakup segala aspek, mulai dari manajemen perusahaan hingga hubungan dengan konsumen dan stakeholders lainnya. Dengan menerapkan prinsip pertanggungjawaban, perusahaan dapat memastikan bahwa setiap tindakan yang diambil memiliki dasar yang jelas dan dapat dipertanggungjawabkan.</p> <p>5. Prinsip Kewajaran: Badan usaha swasta harus menjalankan bisnisnya berdasarkan prinsip keadilan dan kesetaraan. Hal ini mencakup memenuhi hak-hak stakeholders yang timbul berdasarkan perjanjian dan peraturan perundang-undangan yang berlaku. Prinsip kewajaran juga menuntut agar perusahaan tidak berlebihan dalam proses penyelenggaraan usaha, termasuk dalam penerapan harga dan persyaratan. Perlakuan tidak diskriminatif terhadap pihak lain juga merupakan bagian dari prinsip kewajaran.</p>
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		<p>6. Prinsip Kejujuran: Badan usaha swasta harus memberikan informasi yang benar, jelas, dan jujur mengenai kondisi dan keadaan barang atau jasa yang diperdagangkan. Prinsip kejujuran menuntut agar perusahaan tidak menyembunyikan informasi yang dapat merugikan konsumen atau pihak lain. Promosi yang dilakukan juga harus sesuai dengan kondisi sebenarnya, tanpa menyesatkan atau menipu.</p> <p>7. Prinsip Empati: Badan usaha swasta harus memberikan perlakuan kepada stakeholders dan shareholders sesuai dengan yang diinginkan dalam pengelolaan bisnis. Prinsip ini mengedepankan rasa atau nurani dalam melakukan tindakan, sehingga bisnis dapat berjalan dengan lebih humanis dan memperhatikan kepentingan semua pihak yang terlibat.</p> <p>Dengan menerapkan prinsip-prinsip bisnis beretika berkelanjutan di atas, badan usaha swasta dapat memastikan bahwa operasional bisnisnya berjalan dengan baik, memberikan manfaat bagi semua pihak terkait, dan membangun kepercayaan dari masyarakat dan stakeholders.</p>
Apa hak Penyelenggara Publik?	Hak penyelenggara publik adalah hak yang dimiliki oleh individu atau kelompok yang bekerja di sektor publik untuk melaksanakan tugas dan fungsi mereka dengan baik. Hak ini meliputi hak untuk mendapat perlindungan, dukungan, fasilitas, dan sumber daya yang diperlukan untuk menjalankan tugas mereka secara efektif. Selain itu, hak penyelenggara publik juga mencakup hak untuk dihormati, diakui, dan dilindungi dalam melaksanakan tugas mereka tanpa diskriminasi atau intervensi yang tidak sah.	<p>Hak Penyedia Layanan Publik sebagaimana diatur dalam Pasal 14 Undang-Undang Republik Indonesia Nomor 25 Tahun 2009 Tentang Pelayanan publik adalah:</p> <ol style="list-style-type: none"> 1. memberikan pelayanan tanpa dihambat pihak lain yang bukan tugasnya; 2. melakukan kerja sama; 3. mempunyai anggaran pembiayaan penyelenggaraan pelayanan publik; 4. melakukan pembelaan terhadap pengaduan dan tuntutan yang tidak sesuai dengan kenyataan dalam penyelenggaraan pelayanan publik; dan 5. menolak permintaan pelayanan yang bertentangan dengan peraturan

		perundang-undangan.
Apa kewajiban penyelenggara publik?	<p>Kewajiban penyelenggara publik adalah bertanggung jawab atas pelayanan publik yang berkualitas, transparan, akuntabel, dan berkeadilan. Mereka juga harus mematuhi prinsip good governance, seperti integritas, keadilan, dan partisipasi masyarakat. Selain itu, penyelenggara publik juga harus menerima pengaduan dan keluhan masyarakat terkait pelayanan publik yang diberikan.</p>	<p>Kewajiban penyelenggara publik sebagaimana diatur dalam Undang-Undang Republik Indonesia Nomor 25 Tahun 2009 Tentang Pelayanan Publik adalah sebagai berikut:</p> <ol style="list-style-type: none"> 1. Melaksanakan evaluasi terhadap kinerja pelaksana di lingkungan organisasi secara berkala dan berkelanjutan. 2. Melakukan upaya peningkatan kapasitas pelaksana. 3. Melakukan penyeleksian dan promosi pelaksana secara transparan, tidak diskriminatif, dan adil sesuai dengan peraturan perundang-undangan. 4. Memberikan penghargaan kepada pelaksana yang memiliki prestasi kerja. 5. Memberikan hukuman kepada pelaksana yang melakukan pelanggaran ketentuan internal penyelenggara.
Apa hak pelaku usaha?	<p>Hak pelaku usaha adalah hak-hak yang dimiliki oleh individu atau entitas yang terlibat dalam kegiatan usaha atau bisnis. Beberapa hak pelaku usaha antara lain:</p> <ol style="list-style-type: none"> 1. Hak untuk mendirikan dan menjalankan usaha tanpa diskriminasi. 2. Hak untuk mendapatkan perlakuan yang adil dan setara dalam hubungan bisnis. 3. Hak untuk melindungi kekayaan intelektual dan hak cipta. 4. Hak untuk mendapatkan akses yang adil terhadap pasar dan persaingan yang sehat. 5. Hak untuk mendapatkan perlindungan hukum dalam melaksanakan kegiatan usaha. 6. Hak untuk mendapatkan perlindungan terhadap praktik bisnis yang merugikan atau merugikan konsumen atau pesaing. <p>Namun, hak pelaku usaha juga harus diimbangi dengan kewajiban untuk mematuhi peraturan dan regulasi yang</p>	<p>Hak pelaku usaha berdasarkan Undang-Undang Nomor 8 Tahun 1999 tentang Perlindungan Konsumen (UUPK) adalah sebagai berikut:</p> <ol style="list-style-type: none"> 1. Hak untuk menerima pembayaran yang sesuai dengan kesepakatan mengenai kondisi dan nilai tukar barang dan/atau jasa yang diperdagangkan. 2. Hak untuk mendapat perlindungan hukum dari tindakan konsumen yang beritikad tidak baik. 3. Hak untuk melakukan pembelaan diri sepatutnya di dalam penyelesaian hukum sengketa konsumen. 4. Hak untuk rehabilitasi nama baik apabila terbukti secara hukum bahwa kerugian konsumen tidak diakibatkan oleh barang dan/atau jasa yang diperdagangkan. 5. Hak-hak yang diatur dalam ketentuan peraturan perundang-undangan lainnya.

	berlaku serta menjunjung tinggi etika bisnis yang baik.	
Apa kewajiban pelaku usaha?	<p>Pelaku usaha memiliki beberapa kewajiban yang harus dipatuhi sesuai dengan peraturan yang berlaku. Beberapa kewajiban pelaku usaha antara lain adalah:</p> <ol style="list-style-type: none"> 1. Mematuhi peraturan dan regulasi yang berlaku dalam menjalankan usahanya. 2. Melaporkan dan membayar pajak sesuai dengan ketentuan yang berlaku. 3. Mematuhi hak konsumen dan memberikan pelayanan yang baik kepada konsumen. 4. Menjaga lingkungan dan melakukan praktik bisnis yang berkelanjutan. 5. Memberikan informasi yang jujur dan transparan kepada konsumen dan pihak terkait lainnya. 	<p>Kewajiban pelaku usaha berdasarkan Undang-Undang Nomor 8 Tahun 1999 tentang Perlindungan Konsumen (UUPK) adalah sebagai berikut:</p> <ol style="list-style-type: none"> 1. Beritikad baik dalam melakukan kegiatan usahanya 2. Memberikan informasi yang benar, jelas, dan jujur mengenai kondisi dan jaminan barang dan/atau jasa serta memberi penjelasan penggunaan, perbaikan, dan pemeliharaan 3. Memperlakukan atau melayani konsumen secara benar dan jujur serta tidak diskriminatif 4. Menjamin mutu barang dan/atau jasa yang diproduksi dan/atau diperdagangkan berdasarkan ketentuan standar mutu barang dan/atau jasa yang berlaku 5. Memberi kesempatan kepada konsumen untuk menguji, dan/atau mencoba barang dan/atau jasa tertentu serta memberi jaminan dan/atau garansi atas barang yang dibuat dan/atau yang diperdagangkan 6. Memberi kompensasi, ganti rugi dan/atau penggantian atas kerugian akibat penggunaan, pemakaian dan pemanfaatan barang dan/atau jasa yang diperdagangkan 7. Memberi kompensasi, ganti rugi dan/atau penggantian apabila barang dan/atau jasa yang diterima atau dimanfaatkan tidak sesuai dengan perjanjian.
Apa hak konsumen?	<p>Hak konsumen adalah hak-hak yang dimiliki oleh individu sebagai konsumen dalam berbagai transaksi jual beli barang dan jasa. Beberapa hak konsumen yang penting antara lain adalah hak untuk mendapatkan informasi yang jelas dan jujur tentang produk atau jasa yang dibeli, hak untuk mendapatkan produk atau jasa yang aman dan berkualitas, hak untuk mendapat perlindungan terhadap praktik bisnis yang tidak etis atau merugikan konsumen, hak untuk</p>	<p>Hak konsumen berdasarkan Undang-Undang Nomor 8 Tahun 1999 tentang Perlindungan Konsumen (UUPK) Pasal 4 adalah sebagai berikut:</p> <ol style="list-style-type: none"> 1. Hak atas kenyamanan, keamanan, dan keselamatan dalam mengkonsumsi barang dan/atau jasa; 2. Hak untuk memilih barang dan/atau jasa serta mendapatkan barang dan/atau jasa tersebut sesuai dengan nilai tukar dan kondisi serta jaminan yang dijanjikan;

	<p>mendapatkan kompensasi jika terjadi kerugian akibat produk atau jasa yang cacat, serta hak untuk mengajukan keluhan dan mendapatkan penyelesaian yang adil dan cepat. Perlu diketahui bahwa hak konsumen dapat berbeda-beda di setiap negara, namun prinsip-prinsip dasarnya tetap sama, yaitu perlindungan terhadap konsumen dalam transaksi jual beli.</p>	<p>3. Hak atas informasi yang benar, jelas, dan jujur mengenai kondisi dan jaminan barang dan/atau jasa; 4. Hak untuk didengar pendapat dan keluhannya atas barang dan/atau jasa yang digunakan; 5. Hak untuk mendapatkan advokasi, perlindungan, dan upaya penyelesaian sengketa perlindungan konsumen secara patut; 6. Hak untuk mendapat pembinaan dan pendidikan konsumen; 7. Hak untuk diperlakukan atau dilayani secara benar dan jujur serta tidak diskriminatif; 8. Hak untuk mendapatkan kompensasi, ganti rugi/pengganti apabila barang dan/atau jasa yang diterima tidak sesuai dengan perjanjian atau tidak sebagaimana mestinya; 9. Hak-hak yang diatur dalam ketentuan peraturan perundang-undangan lainnya.</p>
Apa kewajiban konsumen?	<p>Kewajiban konsumen adalah sebagai berikut:</p> <ol style="list-style-type: none"> 1. Membayar harga barang atau jasa sesuai dengan kesepakatan yang telah disepakati. 2. Menggunakan barang atau jasa dengan benar dan sesuai dengan kegunaannya. 3. Melakukan pembayaran sesuai dengan jadwal yang telah disepakati. 4. Memberikan informasi yang jujur terkait dengan kebutuhan atau permintaan yang diajukan. 5. Melindungi hak dan keamanan konsumen lainnya. 	<p>Berdasarkan Undang-Undang Nomor 8 Tahun 1999 tentang Perlindungan Konsumen, kewajiban konsumen adalah sebagai berikut:</p> <ol style="list-style-type: none"> 1. Beritikad baik dalam melakukan kegiatan konsumsi. 2. Memberikan informasi yang benar, jelas, dan jujur mengenai kondisi barang dan/atau jasa yang dikonsumsi serta memberikan penjelasan penggunaan, perbaikan, dan pemeliharaan. 3. Memperlakukan penjual atau pemberi jasa secara benar, jujur, dan tidak diskriminatif. 4. Menghormati hak-hak konsumen lain. 5. Membayar harga barang dan/atau jasa sesuai dengan kesepakatan yang telah dibuat. 6. Menggunakan barang dan/atau jasa sesuai dengan peruntukannya. 7. Melakukan tindakan hukum yang diperlukan apabila hak-haknya sebagai konsumen dilanggar. 8. Mematuhi ketentuan-ketentuan yang berlaku dalam perjanjian konsumen.

		<p>9. Menjaga keamanan, kenyamanan, dan keselamatan dalam mengkonsumsi barang dan/atau jasa.</p> <p>10. Menghormati hak-hak konsumen lain sesuai dengan ketentuan perundang-undangan yang berlaku.</p>
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c. General information about LO DIY.

This evaluation tested the QA System's knowledge of fundamental LO DIY information, such as service types and clarification procedures. The results as explained in Table 4.4 shows that RAG QA System was significantly superior by providing specific and relevant answers. The RAG-enabled QA System presented a list of violations and procedural steps accurate to the LO DIY context, unlike the answer from system without RAG, which was merely conceptual and general. This proves that RAG makes the QA System more practical and informative for users.

Table 4.4. Information about LO DIY Result

Questions	Non-RAG QA System Answer	RAG QA System Answer
Jenis-jenis layanan aduan dan pelanggaran yang diterima lo diy apa saja?	<p>Lembaga ombudsman biasanya menerima berbagai jenis aduan dan pelanggaran, termasuk tetapi tidak terbatas pada:</p> <ol style="list-style-type: none"> 1. Penyalahgunaan kekuasaan oleh pihak berwenang 2. Diskriminasi atau perlakuan tidak adil 3. Penyalahgunaan dana publik atau korupsi 4. Pelanggaran hak asasi manusia 5. Kesalahan administratif atau prosedural 6. Ketidakpatuhan terhadap peraturan atau kebijakan 7. Pelayanan publik yang buruk atau tidak memuaskan 8. Pelanggaran etika atau kode etik 9. Penyalahgunaan kekuasaan dalam hubungan kerja 10. Pelanggaran terhadap hukum atau peraturan yang berlaku. <p>Lembaga ombudsman bertugas untuk menangani aduan-aduan tersebut dan</p>	<p>Jenis layanan aduan yang dapat diterima oleh Lembaga Ombudsman Daerah Istimewa Yogyakarta (LO DIY) meliputi pengawasan terhadap penyelenggaraan pelayanan publik oleh aparatur pemerintah maupun badan usaha. Sedangkan jenis pelanggaran yang dapat dilaporkan mencakup:</p> <ol style="list-style-type: none"> 1. Penundaan yang berlarut-larut 2. Tidak memberikan pelayanan sebagaimana mestinya 3. Permintaan imbalan tidak sah 4. Ketidakmampuan atau tidak kompeten dalam melaksanakan tugas 5. Penyalahgunaan wewenang 6. Penyimpangan prosedur 7. Perilaku tidak patut 8. Sikap berpihak yang tidak seharusnya 9. Konflik kepentingan 10. Pelanggaran etika usaha 11. Diskriminasi 12. Ketidak Transparan 13. Ketidakakuntabelan

	memberikan penyelesaian yang adil dan transparan bagi para pengadu.	Penyampaian pengaduan ini bertujuan untuk meningkatkan kualitas pelayanan publik dan menjamin keadilan dalam tata kelola pemerintahan serta badan usaha.
Apa itu klarifikasi? Mengapa klarifikasi diperlukan? Apa yang dilakukan LO DIY pada tahap klarifikasi?	<p>Klarifikasi adalah proses dimana lembaga ombudsman meminta informasi tambahan atau penjelasan dari pihak terkait untuk memahami lebih dalam mengenai suatu keluhan atau pengaduan yang diterima. Klarifikasi diperlukan untuk memastikan bahwa semua informasi yang diperlukan telah terkumpul dengan baik sebelum lembaga ombudsman dapat membuat keputusan atau rekomendasi terkait kasus tersebut.</p> <p>Pada tahap klarifikasi, Lembaga Ombudsman DIY biasanya akan menghubungi pihak yang melakukan pengaduan atau keluhan untuk meminta informasi tambahan atau klarifikasi mengenai permasalahan yang dihadapi. Selain itu, lembaga ombudsman juga dapat melakukan wawancara dengan pihak terkait atau melakukan investigasi lebih lanjut untuk memastikan bahwa semua informasi yang diperlukan telah terkumpul dengan baik sebelum membuat keputusan akhir. Dengan melakukan klarifikasi, lembaga ombudsman dapat memastikan bahwa keputusan atau rekomendasi yang diberikan didasari oleh informasi yang lengkap dan akurat.</p>	<p>Klarifikasi adalah tahap dalam penanganan laporan di LO DIY yang bertujuan untuk memperjelas informasi yang disampaikan oleh pelapor serta memastikan pemahaman yang benar terhadap permasalahan yang dilaporkan. Klarifikasi diperlukan untuk mengumpulkan informasi tambahan, memverifikasi fakta, dan memastikan bahwa semua pihak memiliki pemahaman yang sama mengenai permasalahan yang sedang dihadapi.</p> <p>Pada tahap klarifikasi, LO DIY melakukan hal-hal berikut:</p> <ol style="list-style-type: none"> 1. Memastikan bahwa informasi yang disampaikan oleh pelapor sudah lengkap dan jelas. 2. Memverifikasi fakta-fakta yang disampaikan oleh pelapor. 3. Menggali informasi tambahan yang diperlukan untuk memahami permasalahan secara menyeluruh. 4. Menyediakan kesempatan bagi pihak terlapor untuk memberikan klarifikasi atau penjelasan terkait permasalahan yang dilaporkan. 5. Memastikan bahwa semua pihak terlibat memiliki pemahaman yang sama mengenai permasalahan yang sedang dihadapi. <p>Dengan melakukan klarifikasi, LO DIY dapat memastikan bahwa penyelesaian permasalahan dilakukan berdasarkan informasi yang akurat dan pemahaman yang jelas dari semua pihak yang terlibat.</p>

Identification of Perceived Usefulness Indicator

The Perceived Usefulness indicator was measured using three questions. To determine the assessment criteria in the descriptive analysis, the interval method was applied using the highest and lowest possible scores. The maximum score was calculated by multiplying the number of questions (3) by the highest value on the rating scale (5), resulting in a maximum score of $3 \times 5 = 15$. Meanwhile, the minimum score was obtained by multiplying the number of questions by the lowest value on the scale (1), which is $3 \times 1 = 3$. The interval class was then determined using the calculation below, and the assessment criteria were established as presented in Table 4.5. While, the calculation of the indicator is shown in Table 4.6.

$$\text{Class Interval} = \frac{\Sigma x}{n} = \frac{15 - 3}{5} = 2,4$$

Table 4.5. Scoring Intervals for Perceived Usefulness Criteria

Score Range	Criteria
3 – 5,4	Very Low
5,5 – 7,8	Low
7,9 – 10,2	Moderate
10,3 – 12,6	High
12,7 – 15	Very High

Table 4.6. Results of Perceived Usefulness Indicator Calculation

Criteria	Q1	Q2	Q3	N	N x Skor
SS	0	1	1	2	10
S	4	3	4	11	44
N	1	1	0	2	6
KS	0	0	0	0	0
TS	0	0	0	0	0
Mean					12

Based on Table 4.6., the research findings indicate that the Perceived Usefulness indicator has a mean score of 12. This average falls within the “high” category, according to the interval range of 10.3–12.6. Within this category, the expert assessments show that most respondents selected the “Agree” criterion, with some choosing “Strongly Agree” regarding the perceived benefits for the public. Therefore, it can be concluded that the experts’ perception of the benefits that the public will receive is relatively high.

Identification of Accuracy Indicator

The Accuracy indicator was measured using four questions. To determine the assessment criteria in the descriptive analysis, the interval method was applied using the highest and lowest possible scores. The maximum score was calculated by multiplying the number of questions (4) by the highest value on the rating scale (5), resulting in a maximum score of $4 \times 5 = 20$. Meanwhile, the minimum score was obtained by multiplying the number of questions by the lowest value on the scale (1), which is $4 \times 1 = 4$. The interval class was then determined using the calculation below, and the assessment criteria were established as presented in Table 4.7. While, the calculation of the indicator is shown in Table 4.8.

$$\text{Class Interval} = \frac{\Sigma x}{n} = \frac{20 - 4}{5} = 3,2$$

Table 4.7. Scoring Intervals for Accuracy Criteria

Score Range	Criteria
4 – 7,2	Very Low
7,3 – 10,4	Low
10,5 – 13,6	Moderate
13,7 – 16,8	High
16,9 – 20	Very High

Table 4.8. Results of Accuracy Indicator Calculation

Criteria	Q4	Q5	Q6	Q7	N	N x Skor
SS	3	3	4	3	13	65
S	2	2	1	2	7	93
N	0	0	0	0	0	0
KS	0	0	0	0	0	0
TS	0	0	0	0	0	0
Mean						18,6

Based on Table 4.8., the research findings indicate that the Accuracy indicator has a mean score of 18.6. This average falls within the “very high” category, according to the interval range of 16.9–20. In this category, expert evaluations show that most respondents selected the

“Strongly Agree” criterion, with some choosing “Agree” regarding the accuracy of the QA System's responses. Therefore, it can be concluded that the experts' perception of the QA System's accuracy is classified as very high.

Identification of Relevance Indicator

The Relevance indicator was measured using two questions. To determine the assessment criteria in the descriptive analysis, the interval method was applied using the highest and lowest possible scores. The maximum score was calculated by multiplying the number of questions (2) by the highest value on the rating scale (5), resulting in a maximum score of $2 \times 5 = 10$. Meanwhile, the minimum score was obtained by multiplying the number of questions by the lowest value on the scale (1), which is $2 \times 1 = 2$. The interval class was then determined using the calculation below, and the assessment criteria were established as presented in Table 4.9. While, the calculation of the indicator is shown in Table 4.10.

$$\text{Class Interval} = \frac{\Sigma x}{n} = \frac{10 - 2}{5} = 1,6$$

Table 4.9. Scoring Intervals for Relevance Criteria

Score Range	Criteria
2 – 3,6	Very Low
3,7 – 5,2	Low
5,3 – 6,8	Moderate
6,9 – 8,4	High
8,5 – 10	Very High

Table 4.10. Results of Relevance Indicator Calculation

Criteria	Q8	Q9	N	N x Skor
SS	0	0	0	0
S	5	5	10	40
N	0	0	0	0
KS	0	0	0	0
TS	0	0	0	0
Mean				8

Based on Table 4.10., the research findings indicate that the *Relevance* indicator has a mean score of 8. This average falls within the “high” category, according to the interval range of 6.9–8.4. In this category, expert evaluations show that the experts selected the “Agree” criterion regarding the relevance of the QA System’s responses to the questions asked. Therefore, it can be concluded that the experts’ perception of the QA System’s relevance is classified as high.

Identification of Clarity Indicator

The Clarity indicator was measured using two questions. To determine the assessment criteria in the descriptive analysis, the interval method was applied using the highest and lowest possible scores. The maximum score was calculated by multiplying the number of questions (2) by the highest value on the rating scale (5), resulting in a maximum score of $2 \times 5 = 10$. Meanwhile, the minimum score was obtained by multiplying the number of questions by the lowest value on the scale (1), which is $2 \times 1 = 2$. The interval class was then determined using the calculation below, and the assessment criteria were established as presented in Table 4.11. While, the calculation of the indicator is shown in Table 4.12.

$$\text{Class Interval} = \frac{\Sigma x}{n} = \frac{10 - 2}{5} = 1,6$$

Table 4.11. Scoring Intervals for Clarity Criteria

Score Range	Criteria
2 – 3,6	Very Low
3,7 – 5,2	Low
5,3 – 6,8	Moderate
6,9 – 8,4	High
8,5 – 10	Very High

Table 4.12. Results of Clarity Indicator Calculation

Criteria	Q10	Q11	N	N x Skor
SS	1	1	2	10
S	4	4	8	32
N	0	0	0	0
KS	0	0	0	0
TS	0	0	0	0
Mean				8,4

Based on Table 4.12., the research findings indicate that the Clarity indicator has a mean score of 8.4. This average falls within the “high” category, according to the interval range of 6.9–8.4. In this category, expert evaluations show that the experts selected the “Agree” criterion regarding the ease of understanding and comfort in interacting with the QA System. Therefore, it can be concluded that the experts’ perception of the ease of understanding and comfort in interacting with the QA System is classified as very high.

4.4.2 User Evaluation

The user evaluation was conducted by providing respondents with a set of comparative answers and respondents were given follow-up questions designed to measure their level of comprehension. Based on Figure 4.21, it can be concluded that nine out of ten respondents were able to comprehend the context of the answers generated by the RAG QA System. This finding demonstrates that the majority of users did not encounter significant difficulties in interpreting the meaning or relevance of the system’s responses. In other words, the answers produced by the system were presented in a manner that was clear, structured, and aligned with the questions asked, thereby making them easier for respondents to follow and understand. Thus, this outcome suggests that the system has successfully achieved one of its primary objectives, namely delivering information that is both informative and accessible to users.

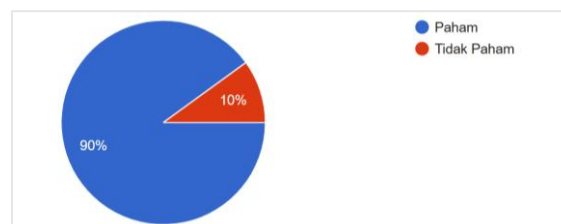


Figure 4.21 Evaluation Result

CHAPTER V

CONCLUSION

5.1 Conclusion

Based on the results of the research conducted, several conclusions can be drawn as follows:

- a. The public faces difficulties in accessing and understanding legal information related to public services. Furthermore, the manual information service system at the Regional Ombudsman of the Special Region of Yogyakarta (LO DIY) is inefficient and prone to repetitive questions.
- b. The research was conducted to develop a QA System as an information retrieval tool for public service legal.
- c. The performance of the RAG QA System was compared to a non-RAG QA System. The evaluation was conducted by five experts from LO DIY using a questionnaire to measure four indicators: Perceived Usefulness, Accuracy, Relevance, and Clarity.
- d. Perceived Usefulness: Scored in the "High" category with an average score of 12, indicating experts believe the QA System is beneficial for the public.
- e. Accuracy: Scored in the "Very High" category with an average score of 18.6, confirming that the system's answers are highly compliant with applicable regulations.
- f. Relevance: Scored in the "High" category with an average score of 8, indicating that the responses are highly relevant to user questions.
- g. Clarity: Scored in the "High" category with an average score of 8.4, showing that the information is presented in a clear and understandable manner.
- h. The user evaluation shows that nine out of ten respondents were able to clearly comprehend the answers generated by the RAG QA System, indicating that the system's output is generally understandable and effective for users.
- i. The research successfully demonstrated that utilizing RAG technology can effectively improve the quality and accessibility of public service legal information.

5.2 Suggestions

Based on the research conducted, there are several suggestions for improvement that can be applied in future development. The recommendations are as follows:

- a. Expand the QA System's knowledge base by integrating a more diverse range of legal documents and implementing an automated update mechanism to ensure informational accuracy.
- b. Enhance user functionality and interactivity by incorporating multi-modal support (e.g., visual outputs), proactive assistance features such as case simulations, and regional language support.
- c. Integrate the QA System into LO DIY's existing service channels to improve user adoption and accessibility.
- d. Integrate the system with a large-capacity, automated database to support a more extensive and dynamic knowledge base.

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LAMPIRAN

<div>Silakan ajukan pertanyaan Anda: exit</div> <div>Terima kasih telah menggunakan layanan kami. Sampai jumpa!</div> <div>PS C:\Users\hp\lchttb> python main.py</div> <div>[12/30/24 09:14:33] INFO Anonymized telemetry enabled. See https://docs.trychroma.com/telemetry for more information.</div> <div>[12/30/24 09:14:35] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"</div> <div>AI Assistant untuk hukum pelayanan publik dan ombudsman siap membantu Anda. Ketik 'exit' untuk keluar.</div> <div>posthog.py:22</div> <div>client.py:1038</div>			
<div>Silakan ajukan pertanyaan Anda: Jenis-jenis layanan aduan dan pelanggaran yang di terima lo diy apa saja?</div> <div>Respon AI:</div> <div>[12/30/24 09:14:48] INFO HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK"</div> <div>[12/30/24 09:14:49] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"</div> <div>INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"</div> <div>INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"</div> <div>C:\Users\hp\lchttb\main.py:145: LangChainBetaWarning: The function `loads` is in beta. It is actively being worked on, so the API may change.</div> <div>return [loads(doc) for doc in unique_docs]</div> <div>[12/30/24 09:14:53] INFO HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK"</div> <div>Jenis layanan aduan yang dapat diterima oleh Lembaga Ombudsman Daerah Istimewa Yogyakarta (LO DIY) meliputi pengawasan terhadap penyelenggaraan pelayanan publik oleh aparaturn pemerintah maupun badan usaha. Sedangkan jenis pelanggaran yang dapat dilaporkan mencakup:</div> <div>1. Penundaan yang berlarut-larut</div> <div>2. Tidak memberikan pelayanan sebagaimana mestinya</div> <div>3. Permintaan imbalan tidak sah</div> <div>4. Ketidakmampuan atau tidak kompeten dalam melaksanakan tugas</div> <div>5. Penyalahgunaan wewenang</div> <div>6. Penyimpangan prosedur</div> <div>7. Perilaku tidak patut</div> <div>8. Sikap berpihak yang tidak seharusnya</div> <div>9. Konflik kepentingan</div> <div>10. Pelanggaran etika usaha</div> <div>11. Diskriminasi</div> <div>12. Ketidaktransparanan</div> <div>13. Ketidakakuntabelan</div> <div>client.py:1038</div> <div>client.py:1038</div> <div>client.py:1038</div> <div>client.py:1038</div> <div>Penyampaian pengaduan ini bertujuan untuk meningkatkan kualitas pelayanan publik dan menjamin keadilan dalam tata kelola pemerintahan serta badan usaha.</div> <div>Silakan ajukan pertanyaan Anda: exit</div> <div>Terima kasih telah menggunakan layanan kami. Sampai jumpa!</div> <div>PS C:\Users\hp\lchttb> █</div> <div>client.py:1038</div>			
<div>PS C:\Users\hp\lchttb> python main.py</div> <div>[01/08/25 11:02:40] INFO Anonymized telemetry enabled. See https://docs.trychroma.com/telemetry for more information.</div> <div>[01/08/25 11:02:45] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"</div> <div>AI Assistant untuk hukum pelayanan publik dan ombudsman siap membantu Anda. Ketik 'exit' untuk keluar.</div> <div>posthog.py:22</div> <div>client.py:1038</div>			
<div>Silakan ajukan pertanyaan Anda: Apa hak pelaku usaha?</div> <div>Respon AI:</div> <div>[01/08/25 11:03:07] INFO HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK"</div> <div>INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"</div> <div>[01/08/25 11:03:08] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"</div> <div>INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"</div> <div>C:\Users\hp\lchttb\main.py:146: LangChainBetaWarning: The function `loads` is in beta. It is actively being worked on, so the API may change.</div> <div>return [loads(doc) for doc in unique_docs]</div> <div>[01/08/25 11:03:11] INFO HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK"</div> <div>Hak pelaku usaha berdasarkan Undang-Undang Nomor 8 Tahun 1999 tentang Perlindungan Konsumen (UUPK) adalah sebagai berikut:</div> <div>1. Hak untuk menerima pembayaran yang sesuai dengan kesepakatan mengenai kondisi dan nilai tukar barang dan/atau jasa yang diperdagangkan.</div> <div>2. Hak untuk mendapat perlindungan hukum dari tindakan konsumen yang beritikad tidak baik.</div> <div>3. Hak untuk melakukan pembelaan diri sepatutnya di dalam penyelesaian hukum sengketa konsumen.</div> <div>4. Hak untuk rehabilitasi nama baik apabila terbukti secara hukum bahwa kerugian konsumen tidak diakibatkan oleh barang dan/atau jasa yang diperdagangkan.</div> <div>5. Hak-hak yang diatur dalam ketentuan peraturan perundang-undangan lainnya.</div> <div>client.py:1038</div> <div>client.py:1038</div> <div>client.py:1038</div> <div>client.py:1038</div> <div>client.py:1038</div> <div>client.py:1038</div> <div>client.py:1038</div> <div>client.py:1038</div>			
<div>Silakan ajukan pertanyaan Anda: Apa kewajiban pelaku usaha?</div> <div>Respon AI:</div> <div>[01/08/25 11:05:56] INFO HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK"</div> <div>INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"</div> <div>INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"</div> <div>INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"</div> <div>INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"</div> <div>[01/08/25 11:05:57] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"</div> <div>[01/08/25 11:06:01] INFO HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK"</div> <div>Kewajiban pelaku usaha berdasarkan Undang-Undang Nomor 8 Tahun 1999 tentang Perlindungan Konsumen (UUPK) adalah sebagai berikut:</div> <div>1. Beritikad baik dalam melakukan kegiatan usahanya</div> <div>2. Memberikan informasi yang benar, jelas, dan jujur mengenai kondisi dan jaminan barang dan/atau jasa serta memberi penjelasan penggunaan, perbaikan, dan pemeliharaan</div> <div>3. Memperlakukan atau melayani konsumen secara benar dan jujur serta tidak diskriminatif</div> <div>4. Menjamin mutu barang dan/atau jasa yang diproduksi dan/atau diperdagangkan berdasarkan ketentuan standar mutu barang dan/atau jasa yang berlaku</div> <div>5. Memberi kesempatan kepada konsumen untuk menguji, dan/atau mencoba barang dan/atau jasa tertentu serta memberi jaminan dan/atau garansi atas barang yang dibuat dan/atau yang diperdagangkan</div> <div>6. Memberi kompensasi, ganti rugi dan/atau penggantian atas kerugian akibat penggunaan, pemakaian dan pemanfaatan barang dan/atau jasa yang diperdagangkan</div> <div>7. Memberi kompensasi, ganti rugi dan/atau penggantian apabila barang dan/atau jasa yang diterima atau dimanfaatkan tidak sesuai dengan perjanjian.</div> <div>client.py:1038</div> <div>client.py:1038</div> <div>client.py:1038</div> <div>client.py:1038</div> <div>client.py:1038</div> <div>client.py:1038</div> <div>client.py:1038</div> <div>client.py:1038</div>			
<div>Silakan ajukan pertanyaan Anda: Jelaskan apa yang di maksud etika bisnis?</div> <div>Respon AI:</div> <div>[01/08/25 11:09:48] INFO HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK"</div> <div>[01/08/25 11:09:49] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"</div> <div>INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"</div> <div>INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK"</div> <div>C:\Users\hp\lchttb\main.py:146: LangChainBetaWarning: The function `loads` is in beta. It is actively being worked on, so the API may change.</div> <div>return [loads(doc) for doc in unique_docs]</div> <div>[01/08/25 11:09:52] INFO HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK"</div> <div>Etika bisnis adalah seperangkat prinsip moral dan nilai-nilai yang mengatur perilaku dan tindakan dalam dunia bisnis. Etika bisnis menekankan pentingnya integritas, kejujuran, tanggung jawab sosial, dan keadilan dalam setiap keputusan dan tindakan yang diambil oleh pelaku bisnis. Hal ini bertujuan untuk memastikan bahwa bisnis beroperasi dengan cara yang sesuai dengan norma-norma moral dan hukum yang berlaku, serta memberikan kontribusi positif bagi masyarakat dan lingkungan sekitar. Etika bisnis juga melibatkan pertimbangan terhadap dampak sosial, lingkungan, dan ekonomi dari setiap keputusan bisnis yang diambil.</div> <div>client.py:1038</div> <div>client.py:1038</div> <div>client.py:1038</div> <div>client.py:1038</div>			

```
[01/08/25 15:02:05] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK" client.py:1038
[01/08/25 15:02:05] INFO HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK" client.py:1038
Jawaban: Prinsip-prinsip bisnis beretika berkelanjutan yang harus diterapkan oleh badan usaha swasta (perusahaan) adalah sebagai berikut:
```

1. Prinsip Ketaatan Hukum: Badan usaha swasta harus taat pada aturan hukum yang berlaku, baik itu undang-undang maupun peraturan lainnya. Hal ini mencakup kesepakatan atau perjanjian yang dibuat oleh para pihak. Dengan menerapkan prinsip ketaatan hukum, diharapkan badan usaha dapat menciptakan keteraturan, menghindari penyimpangan, dan mengurangi dampak negatif yang ditimbulkan.
2. Prinsip Transparansi: Badan usaha swasta harus bersedia untuk melakukan keterbukaan dalam proses pengambilan keputusan dan memberikan informasi yang relevan kepada stakeholder dan shareholder. Transparansi ini mencakup informasi mengenai jasa, produk, kebijakan, dan segala hal yang berhubungan dengan perusahaan. Dengan menerapkan prinsip transparansi, diharapkan badan usaha dapat membangun kepercayaan dari pihak terkait.
3. Prinsip Akuntabilitas: Badan usaha swasta harus memiliki kejelasan fungsi, pelaksanaan, dan pertanggungjawaban manajemen perusahaan. Hal ini berarti bahwa perusahaan harus dapat bertanggung jawab secara efektif dan efisien dalam menjalankan operasionalnya. Standar Operasional Prosedur (SOP) dapat menjadi salah satu cara untuk mengukur tingkat akuntabilitas perusahaan.
4. Prinsip Pertanggungjawaban: Badan usaha swasta harus siap untuk bertanggung jawab atas segala tindakan dan keputusan yang diambil dalam menjalankan bisnisnya. Pertanggungjawaban ini mencakup segala aspek, mulai dari manajemen perusahaan hingga hubungan dengan konsumen dan stakeholders lainnya. Dengan menerapkan prinsip pertanggungjawaban, perusahaan dapat memastikan bahwa setiap tindakan yang diambil memiliki dasar yang jelas dan dapat dipertanggungjawabkan.
5. Prinsip Kewajaran: Badan usaha swasta harus menjalankan bisnisnya berdasarkan prinsip keadilan dan kesetaraan. Hal ini mencakup memenuhi hak-hak stakeholders yang timbul berdasarkan perjanjian dan peraturan perundang-undangan yang berlaku. Prinsip kewajaran juga menuntut agar perusahaan tidak berlebihan dalam proses penyelenggaraan usaha, termasuk dalam penerapan harga dan persyaratan. Perlakuan tidak diskriminatif terhadap pihak lain juga merupakan bagian dari prinsip kewajaran.
6. Prinsip Kejujuran: Badan usaha swasta harus memberikan informasi yang benar, jelas, dan jujur mengenai kondisi dan keadaan barang atau jasa yang diperdagangkan. Prinsip kejujuran menuntut agar perusahaan tidak menyembunyikan informasi yang dapat merugikan konsumen atau pihak lain. Promosi yang dilakukan juga harus sesuai dengan kondisi sebenarnya, tanpa menyesatkan atau menipu.
7. Prinsip Empati: Badan usaha swasta harus memberikan perlakuan kepada stakeholders dan shareholders sesuai dengan yang diinginkan dalam pengelolaan bisnis. Prinsip ini mengedepankan rasa atau nurani dalam melakukan tindakan, sehingga bisnis dapat berjalan dengan lebih humanis dan memperhatikan kepentingan semua pihak yang terlibat.

Dengan menerapkan prinsip-prinsip bisnis beretika berkelanjutan di atas, badan usaha swasta dapat memastikan bahwa operasional bisnisnya berjalan dengan baik, memberikan manfaat bagi semua pihak terkait, dan membangun kepercayaan dari masyarakat dan stakeholders.

Silakan ajukan pertanyaan Anda: █

Silakan ajukan pertanyaan Anda: Apa hak konsumen?

```
Respon AI:
[01/08/25 11:19:10] INFO HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK" client.py:1038
[01/08/25 11:19:10] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK" client.py:1038
[01/08/25 11:19:10] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK" client.py:1038
[01/08/25 11:19:10] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK" client.py:1038
[01/08/25 11:19:11] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK" client.py:1038
[01/08/25 11:19:11] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK" client.py:1038
[01/08/25 11:19:14] INFO HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK" client.py:1038
```

Hak konsumen berdasarkan Undang-Undang Nomor 8 Tahun 1999 tentang Perlindungan Konsumen (UUPK) Pasal 4 adalah sebagai berikut:

1. Hak atas kenyamanan, keamanan, dan keselamatan dalam mengkonsumsi barang dan/atau jasa;
2. Hak untuk memilih barang dan/atau jasa serta mendapatkan barang dan/atau jasa tersebut sesuai dengan nilai tukar dan kondisi serta jaminan yang dijanjikan;
3. Hak atas informasi yang benar, jelas, dan jujur mengenai kondisi dan jaminan barang dan/atau jasa;
4. Hak untuk didengar pendapat dan keluhannya atas barang dan/atau jasa yang digunakan;
5. Hak untuk mendapatkan advokasi, perlindungan, dan upaya penyelesaian sengketa perlindungan konsumen secara patut;
6. Hak untuk mendapat pembinaan dan pendidikan konsumen;
7. Hak untuk diperlakukan atau dilayani secara benar dan jujur serta tidak diskriminatif;
8. Hak untuk mendapatkan kompensasi, ganti rugi/pengganti apabila barang dan/atau jasa yang diterima tidak sesuai dengan perjanjian atau tidak sebagaimana mestinya;
9. Hak-hak yang diatur dalam ketentuan peraturan perundang-undangan lainnya.

Silakan ajukan pertanyaan Anda: Apa kewajiban konsumen?

```
Respon AI:
[01/08/25 11:21:43] INFO HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK" client.py:1038
[01/08/25 11:21:44] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK" client.py:1038
[01/08/25 11:21:44] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK" client.py:1038
[01/08/25 11:21:44] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK" client.py:1038
[01/08/25 11:21:45] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK" client.py:1038
[01/08/25 11:21:45] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK" client.py:1038
[01/08/25 11:21:54] INFO HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK" client.py:1038
```

Jawaban: Berdasarkan Undang-Undang Nomor 8 Tahun 1999 tentang Perlindungan Konsumen, kewajiban konsumen adalah sebagai berikut:

1. Beritikad baik dalam melakukan kegiatan konsumsi.
2. Memberikan informasi yang benar, jelas, dan jujur mengenai kondisi barang dan/atau jasa yang dikonsumsi serta memberikan penjelasan penggunaan, perbaikan, dan pemeliharaan.
3. Memperlakukan penjual atau pemberi jasa secara benar, jujur, dan tidak diskriminatif.
4. Menghormati hak-hak konsumen lain.
5. Membayar harga barang dan/atau jasa sesuai dengan kesepakatan yang telah dibuat.
6. Menggunakan barang dan/atau jasa sesuai dengan peruntukannya.
7. Melakukan tindakan hukum yang diperlukan apabila hak-haknya sebagai konsumen dilanggar.
8. Mematuhi ketentuan-ketentuan yang berlaku dalam perjanjian konsumen.
9. Menjaga keamanan, kenyamanan, dan keselamatan dalam mengkonsumsi barang dan/atau jasa.
10. Menghormati hak-hak konsumen lain sesuai dengan ketentuan perundang-undangan yang berlaku.

Silakan ajukan pertanyaan Anda: Apa saja ketentuan, pembatasan dan larangan dalam melakukan investigasi?

```
Respon AI:
[01/08/25 15:44:39] INFO HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK" client.py:103
[01/08/25 15:44:40] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK" client.py:103
[01/08/25 15:44:44] INFO HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK" client.py:103
```

Jawaban: Dalam melakukan investigasi, terdapat beberapa ketentuan, pembatasan, dan larangan yang harus diperhatikan, antara lain:

1. Ketentuan:
 - Investigasi dilakukan berdasarkan kewenangan LO DIY terkait pengawasan terhadap penyelenggaraan pelayanan publik oleh aparat pemerintah maupun badan usaha.
 - Investigasi dilakukan secara objektif, transparan, dan independen.
 - Investigasi dilakukan dengan mengumpulkan bukti-bukti yang relevan dan valid.
 - Investigasi dilakukan dengan menghormati hak-hak semua pihak yang terlibat.
2. Pembatasan:
 - Investigasi hanya dilakukan terhadap kasus-kasus yang masuk dalam lingkup kewenangan LO DIY.
 - Investigasi tidak boleh melanggar hak-hak individu yang terlibat dalam kasus yang sedang diselidiki.
 - Investigasi harus dilakukan sesuai dengan prosedur dan mekanisme yang telah ditetapkan.
3. Larangan:
 - Tidak boleh melakukan investigasi tanpa dasar hukum yang jelas.
 - Tidak boleh melakukan investigasi yang bersifat diskriminatif atau merugikan pihak tertentu.
 - Tidak boleh melakukan investigasi yang melanggar etika dan norma hukum yang berlaku.

Dengan mematuhi ketentuan, pembatasan, dan larangan tersebut, LO DIY dapat menjalankan fungsi investigasi secara profesional dan bertanggung jawab.

Silakan ajukan pertanyaan Anda: Apa itu klarifikasi? Mengapa klarifikasi diperlukan? Apa yang dilakukan LO DIY pada tahap klarifikasi?

```
Respon AI:
[01/08/25 15:47:01] INFO HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK" client.py:1038
[01/08/25 15:47:02] INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK" client.py:1038
INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK" client.py:1038
INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK" client.py:1038
INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK" client.py:1038
INFO HTTP Request: POST https://api.openai.com/v1/embeddings "HTTP/1.1 200 OK" client.py:1038
[01/08/25 15:47:06] INFO HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK" client.py:1038
```

Klarifikasi adalah tahap dalam penanganan laporan di LO DIY yang bertujuan untuk memperjelas informasi yang disampaikan oleh pelapor serta memastikan pemahaman yang benar terhadap permasalahan yang dilaporkan. Klarifikasi diperlukan untuk mengumpulkan informasi tambahan, memverifikasi fakta, dan memastikan bahwa semua pihak memiliki pemahaman yang sama mengenai permasalahan yang sedang dihadapi.

Pada tahap klarifikasi, LO DIY melakukan hal-hal berikut:

1. Memastikan bahwa informasi yang disampaikan oleh pelapor sudah lengkap dan jelas.
2. Memverifikasi fakta-fakta yang disampaikan oleh pelapor.
3. Menggali informasi tambahan yang diperlukan untuk memahami permasalahan secara menyeluruh.
4. Menyediakan kesempatan bagi pihak terlapor untuk memberikan klarifikasi atau penjelasan terkait permasalahan yang dilaporkan.
5. Memastikan bahwa semua pihak terlibat memiliki pemahaman yang sama mengenai permasalahan yang sedang dihadapi.

Dengan melakukan klarifikasi, LO DIY dapat memastikan bahwa penyelesaian permasalahan dilakukan berdasarkan informasi yang akurat dan pemahaman yang jelas dari semua pihak yang terlibat.

```
PS C:\Users\hp\lchttb> python prompt.py
C:\Users\hp\lchttb\prompt.py:22: LangChainDeprecationWarning: Please see the migration guide at: https://python.langchain.com/docs/migrating_memory/
  memory = ConversationBufferMemory(
C:\Users\hp\lchttb\prompt.py:37: LangChainDeprecationWarning: The class `LLMChain` was deprecated in LangChain 0.1.17 and will be removed in 1.0. Use :meth:`~RunnableSequence`, e.g., `prompt | llm` instead.
  ombudsman_chain = LLMChain(llm=chat, prompt=ombudsman_prompt, memory=memory)
>> sebutkan pasal dalam undang undang terkait tujuan undang undang tentang pelayanan publik
C:\Users\hp\lchttb\prompt.py:47: LangChainDeprecationWarning: The method `Chain.run` was deprecated in langchain 0.1.0 and will be removed in 1.0. Use :meth:`~invoke` instead.
  result = ombudsman_chain.run({"content": content})
Pasal 1 Undang-Undang Nomor 25 Tahun 2009 tentang Pelayanan Publik menyebutkan bahwa tujuan undang-undang tersebut adalah untuk memberikan pelayanan publik yang mudah, cepat, dan terjangkau bagi masyarakat serta memberikan perlindungan hukum bagi masyarakat dalam mendapatkan pelayanan publik. Selain itu, undang-undang ini juga bertujuan untuk mendorong peningkatan kualitas pelayanan publik dan meningkatkan kepuasan masyarakat terhadap pelayanan yang diberikan oleh instansi pelayanan publik.
>>
Ya, saya siap membantu Anda dengan pertanyaan apa pun tentang lembaga ombudsman. Silakan ajukan pertanyaan Anda dan saya akan berusaha memberikan informasi yang akurat dan informatif.
>> █
```

```
Goodbye!
PS C:\Users\hp\lchttb> python test.py
C:\Users\hp\lchttb\test.py:22: LangChainDeprecationWarning: Please see the migration guide at: https://python.langchain.com/docs/migrating_memory/
  memory = ConversationBufferMemory(
C:\Users\hp\lchttb\test.py:37: LangChainDeprecationWarning: The class `LLMChain` was deprecated in LangChain 0.1.17 and will be removed in 1.0. Use :meth:`~RunnableSequence`, e.g., `prompt | llm` instead.
  ombudsman_chain = LLMChain(llm=chat, prompt=ombudsman_prompt, memory=memory)
>> apa itu lo diy?
C:\Users\hp\lchttb\test.py:47: LangChainDeprecationWarning: The method `Chain.run` was deprecated in langchain 0.1.0 and will be removed in 1.0. Use :meth:`~invoke` instead.
  result = ombudsman_chain.run({"content": content})
Lembaga Ombudsman (LO) adalah lembaga independen yang bertugas untuk mengawasi pelayanan publik dan menyelesaikan keluhan masyarakat terkait dengan penyelenggaraan pelayanan publik. LO biasanya berperan sebagai mediator antara pihak yang mengeluh dengan pihak yang dikeluhkan, serta memberikan rekomendasi atau saran untuk meningkatkan kinerja lembaga yang bersangkutan.
```

>> bagaimana alur pelaporan di lo diy?

Untuk melaporkan suatu masalah ke Ombudsman DIY, Anda dapat mengikuti alur pelaporan sebagai berikut:

1. Pertama, pastikan Anda sudah memiliki informasi lengkap mengenai masalah yang ingin dilaporkan, termasuk bukti-bukti yang mendukung.
2. Selanjutnya, Anda dapat mengunjungi website resmi Ombudsman DIY untuk mengetahui prosedur pelaporan yang berlaku.
3. Anda bisa menghubungi Ombudsman DIY melalui telepon atau datang langsung ke kantor mereka untuk melakukan pelaporan.
4. Setelah melaporkan masalah, Ombudsman DIY akan melakukan penyelidikan dan menindaklanjuti sesuai dengan prosedur yang berlaku.
5. Anda juga dapat memantau perkembangan pelaporan Anda melalui website resmi Ombudsman DIY atau menghubungi mereka untuk informasi lebih lanjut.

Demikianlah alur pelaporan di Ombudsman DIY, semoga informasi ini membantu. Jika Anda memiliki pertanyaan lebih lanjut, jangan ragu untuk bertanya.

.. █

```
PS C:\Users\hp\lchttb> python main.py
AI Legal Assistant is now running. Type 'exit' to quit.

Ask a question: bagaimana alur pelaporan lo diy
C:\Users\hp\lchttb\main.py:60: LangChainBetaWarning: The function `loads` is in beta. It is actively being worked on, so the API may change.
  return [loads(doc) for doc in unique_docs]

AI Response:
Alur pelaporan di Lembaga Ombudsman Daerah Istimewa Yogyakarta (LO DIY) dapat dilakukan dengan dua cara, yaitu datang langsung ke kantor LO DIY atau melalui media elektronik. Jika ingin melaporkan secara langsung, warga atau orang yang mewakili dapat datang langsung ke kantor LO DIY, menemui Staf Pengaduan atau Asisten Bidang Pelayanan Laporan, dan mengisi formulir yang disediakan. Sedangkan jika ingin melaporkan melalui media elektronik, keluhan terkait penyelenggaraan pelayanan publik dapat disampaikan melalui surat, SMS, WhatsApp, email, telepon, direct message media sosial LO DIY, atau website dengan mengisi formulir konsultasi online yang telah disediakan. Penting untuk dicatat bahwa pelayanan yang diberikan oleh LO DIY bersifat gratis, dan pelapor dapat meminta agar identitasnya dirahasiakan.
```

Ask a question: apa tujuan dibentuknya lo diy?

AI Response:
Tujuan dibentuknya LO DIY adalah untuk mendorong terwujudnya penyelenggaraan pemerintahan yang baik dan bersih, membantu warga masyarakat memperoleh pelayanan publik yang baik, meningkatkan mutu penyelenggaraan pelayanan publik, memfasilitasi mediasi untuk perlindungan hukum, mendorong penyelenggaraan usaha yang baik dan bersih, serta mendorong praktik dunia usaha yang profesional dan beretika.

```
PS C:\Users\hp\lchttbt> python main.py
Shell for C:\Users\hp\lchttbt\lenv already activated.
New shell not activated to avoid nested environments.
PS C:\Users\hp\lchttbt> python main.py
AI Legal Assistant is now running. Type 'exit' to quit.
```

Ask a question: Jenis-jenis layanan aduan dan pelanggaran yang di terima lo diy apa saja?

```
C:\Users\hp\lchttbt\main.py:60: LangChainBetaWarning: The function `loads` is in beta. It is actively being worked on, so the API may change.
```

```
    return [loads(doc) for doc in unique_docs]
```

AI Response:

Jenis-jenis layanan aduan yang dapat diterima oleh Lembaga Ombudsman Daerah Istimewa Yogyakarta (LO DIY) meliputi pengawasan terhadap penyelenggaraan pelayanan publik oleh aparat pemerintah maupun badan usaha, mencakup bidang pendidikan, lingkungan, kepegawaian, kesejahteraan, keuangan, properti, jasa, keterbukaan informasi, dan pertanahan. Sedangkan jenis pelanggaran yang dapat dilaporkan mencakup penundaan yang berlarut-larut, tidak memberikan pelayanan sebagaimana mestinya, permintaan imbalan tidak sah, ketidakmampuan atau tidak kompeten dalam melaksanakan tugas, penyalahgunaan wewenang, penyimpangan prosedur, perilaku tidak patut, sikap berpihak yang tidak seharusnya, konflik kepentingan, pelanggaran etika usaha, diskriminasi, ketidaktransparanan, dan ketidakakuntabelan.

>> Jenis-jenis layanan aduan dan pelanggaran yang di terima lo diy apa saja?

```
C:\Users\hp\lchttbt\test.py:47: LangChainDeprecationWarning: The method `Chain.run` was deprecated in langchain 0.1.0 and will be removed in 1.0. Use `meth:~invoke` instead.
```

```
    result = ombudsman_chain.run({"content": content})
```

Lembaga ombudsman biasanya menerima aduan terkait pelanggaran administratif atau penyalahgunaan kekuasaan oleh pihak-pihak yang berwenang, seperti pelayanan buruk, penyalahgunaan wewenang, ketidakadilan, diskriminasi, pelanggaran hak asasi manusia, korupsi, dan lain sebagainya. Layanan aduan yang diterima oleh lembaga ombudsman dapat berupa aduan tertulis maupun lisan, dan biasanya dilakukan melalui formulir aduan yang telah disediakan. Selain itu, lembaga ombudsman juga dapat memberikan informasi dan bantuan kepada masyarakat terkait hak-hak mereka terkait dengan pelayanan publik.

Ombudsman adalah untuk menyelesaikan sengketa tersebut dengan cara mediasi, investigasi, atau rekomendasi kepada pihak yang bersangkutan.

>> apa itu asisten lo?

Asisten LO adalah singkatan dari Asisten Lembaga Ombudsman. Asisten LO biasanya adalah staf atau pegawai yang membantu ombudsman dalam melakukan tugas-tugasnya, seperti menyelidiki pengaduan masyarakat, mengumpulkan bukti, dan memberikan rekomendasi untuk penyelesaian masalah yang diajukan. Mereka bekerja di bawah supervisi langsung ombudsman dan bertanggung jawab atas mendukung proses pengawasan dan penegakan hukum yang dilakukan oleh lembaga ombudsman.

>> jenis jenis layanan aduan yang dapat diterima lo itu apa aja?

Ada beberapa jenis layanan aduan yang dapat diterima oleh lembaga ombudsman, antara lain:

1. Aduan terkait dengan pelayanan publik, seperti lambatnya pelayanan, ketidakprofesionalan petugas, atau penyelewengan dalam penyaluran bantuan sosial.
2. Aduan terkait dengan pelanggaran hak asasi manusia, seperti diskriminasi, penyalahgunaan kekuasaan, atau perlakuan tidak adil.
3. Aduan terkait dengan korupsi, seperti penyalahgunaan anggaran, suap, atau nepotisme.
4. Aduan terkait dengan penyimpangan hukum, seperti penyalahgunaan wewenang, pelanggaran prosedur, atau ketidakpatuhan terhadap peraturan.
5. Aduan terkait dengan ketidakpuasan terhadap kebijakan atau program pemerintah, seperti kebijakan yang merugikan masyarakat atau program yang tidak efektif.

>> bagaimana alur pelaporan?

Alur pelaporan pada lembaga ombudsman umumnya melibatkan beberapa langkah yang harus diikuti oleh pelapor. Pertama, pelapor harus mengumpulkan bukti-bukti yang mendukung untuk menyelesaikan masalah yang dilaporkan.

Selama proses pelaporan, lembaga ombudsman biasanya akan menjaga kerahasiaan identitas pelapor dan informasi yang diberikan, kecuali jika pelapor memberikan izin untuk mengungkapkannya. Selain itu, lembaga ombudsman juga akan memberikan informasi kepada pelapor mengenai perkembangan kasus yang dilaporkan secara berkala.

>> apa itu investigasi?

Investigasi adalah proses penyelidikan yang dilakukan untuk mengumpulkan bukti atau informasi terkait suatu masalah atau kejadian tertentu. Investigasi biasanya dilakukan oleh lembaga ombudsman atau lembaga penegak hukum untuk mengungkap kebenaran dan menentukan tanggung jawab dalam suatu kasus. Tujuan dari investigasi adalah untuk menemukan fakta-fakta yang relevan, menganalisis informasi yang diperoleh, dan membuat rekomendasi atau tindakan yang diperlukan berdasarkan hasil investigasi tersebut.

>> exit

Goodbye!

```
PS C:\Users\hp\lchttbt> []
```

>> Apa hak pelaku usaha?

```
C:\Users\hp\lchttbt\test.py:47: LangChainDeprecationWarning: The method `Chain.run` was deprecated in langchain 0.1.0 and will be removed in 1.0. Use `meth:~invoke` instead.
```

```
    result = ombudsman_chain.run({"content": content})
```

Hak pelaku usaha adalah hak-hak yang dimiliki oleh individu atau entitas yang terlibat dalam kegiatan usaha atau bisnis. Beberapa hak pelaku usaha antara lain:

1. Hak untuk mendirikan dan menjalankan usaha tanpa diskriminasi.
 2. Hak untuk mendapatkan perlakuan yang adil dan setara dalam hubungan bisnis.
 3. Hak untuk melindungi kekayaan intelektual dan hak cipta.
 4. Hak untuk mendapatkan akses yang adil terhadap pasar dan persaingan yang sehat.
 5. Hak untuk mendapatkan perlindungan hukum dalam melaksanakan kegiatan usaha.
 6. Hak untuk mendapatkan perlindungan terhadap praktik bisnis yang merugikan atau merugikan konsumen atau pesaing.
- Ada beberapa prinsip bisnis beretika berkelanjutan yang harus diterapkan oleh badan usaha swasta (perusahaan), antara lain:

1. Tanggung jawab sosial: Perusahaan harus mempertimbangkan dampak dari keputusan bisnis mereka terhadap masyarakat dan lingkungan sekitar. Mereka harus bertanggung jawab atas keberlanjutan sosial dan lingkungan.
2. Transparansi: Perusahaan harus transparan dalam menjalankan bisnis mereka, termasuk dalam hal keuangan, kebijakan, dan praktik bisnis. Transparansi membantu membangun kepercayaan dengan para pemangku kepentingan.
3. Kepatuhan terhadap hukum dan peraturan: Perusahaan harus mematuhi semua hukum dan peraturan yang berlaku dalam menjalankan bisnis mereka. Hal ini termasuk dalam hal perlindungan lingkungan, hak asasi manusia, dan perlakuan yang adil terhadap karyawan.
4. Pengelolaan risiko: Perusahaan harus mengelola risiko secara proaktif, termasuk risiko lingkungan, sosial, dan tata kelola perusahaan. Mereka harus memiliki kebijakan dan prosedur yang memastikan risiko-risiko ini dikelola dengan baik.
5. Keterlibatan pemangku kepentingan: Perusahaan harus berkomunikasi dan berinteraksi dengan semua pemangku kepentingan mereka, termasuk karyawan, pelanggan, pemasok, dan masyarakat setempat. Keterlibatan ini membantu memastikan bahwa keputusan bisnis yang diambil memperhitungkan kepentingan semua pihak terkait.

Dengan menerapkan prinsip-prinsip ini, perusahaan dapat menjalankan bisnis mereka secara berkelanjutan dan beretika, serta memberikan dampak positif bagi masyarakat dan lingkungan sekitar.

>> []

>> apa hak konsumen?

Hak konsumen adalah hak-hak yang dimiliki oleh individu sebagai konsumen dalam berbagai transaksi jual beli barang dan jasa. Beberapa hak konsumen yang penting antara lain adalah hak untuk mendapatkan informasi yang jelas dan jujur tentang produk atau jasa yang dibeli, hak untuk mendapatkan produk atau jasa yang aman dan berkualitas, hak untuk mendapatkan perlindungan terhadap praktik bisnis yang tidak etis atau merugikan konsumen, hak untuk mendapatkan kompensasi jika terjadi kerugian akibat produk atau jasa yang cacat, serta hak untuk mengajukan keluhan dan mendapatkan penyelesaian yang adil dan cepat. Perlu diketahui bahwa hak konsumen dapat berbeda-beda di setiap negara, namun prinsip-prinsip dasarnya tetap sama, yaitu perlindungan terhadap konsumen dalam transaksi jual beli.

>> []

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>> Apa kewajiban konsumen?

Kewajiban konsumen adalah sebagai berikut:

1. Membayar harga barang atau jasa sesuai dengan kesepakatan yang telah disepakati.
2. Menggunakan barang atau jasa dengan benar dan sesuai dengan kegunaannya.
3. Melakukan pembayaran sesuai dengan jadwal yang telah disepakati.
4. Memberikan informasi yang jujur terkait dengan kebutuhan atau permintaan yang diajukan.
5. Melindungi hak dan keamanan konsumen lainnya.

>> Apa saja ketentuan, pembatasan dan larangan dalam melakukan investigasi?

```
C:\Users\hp\p\chttb\test.py:47: LangChainDeprecationWarning: The method 'Chain.run' was deprecated in langchain 0.1.0 and will be removed in 1.0. Use :meth:'~invoke' instead.  
    result = ombudsman_chain.run({'content': content})
```

Dalam melakukan investigasi sebagai lembaga ombudsman, terdapat beberapa ketentuan, pembatasan, dan larangan yang perlu diperhatikan, antara lain:

1. Ketentuan:

- Memiliki wewenang untuk mengakses dokumen dan informasi yang relevan untuk investigasi.
- Menyelenggarakan investigasi secara independen dan obyektif.
- Memberikan kesempatan kepada pihak yang bersangkutan untuk memberikan klarifikasi atau pembelaan.
- Mengumpulkan bukti dan informasi secara teliti dan akurat.

2. Pembatasan:

- Tidak boleh melanggar hak asasi manusia dalam melakukan investigasi.
- Tidak boleh melakukan investigasi terhadap kasus yang sedang dalam proses hukum.
- Tidak boleh menggunakan informasi yang diperoleh secara tidak sah dalam investigasi.

3. Larangan:

- Tidak boleh melakukan investigasi tanpa dasar hukum yang jelas.
- Tidak boleh menggunakan informasi yang diperoleh dalam investigasi untuk kepentingan pribadi atau kelompok.
- Tidak boleh memberikan informasi yang tidak benar atau menyesatkan dalam laporan investigasi.

Dengan mematuhi ketentuan, pembatasan, dan larangan tersebut, lembaga ombudsman dapat menjalankan tugasnya secara profesional dan berkualitas.

>> Apa itu klarifikasi? Mengapa klarifikasi diperlukan? Apa yang dilakukan LO DIY pada tahap klarifikasi?

Klarifikasi adalah proses dimana lembaga ombudsman meminta informasi tambahan atau penjelasan dari pihak terkait untuk memahami lebih dalam mengenai suatu keluhan atau pengaduan yang diterima. Klarifikasi diperlukan untuk memastikan bahwa semua informasi yang diperlukan telah terkumpul dengan baik sebelum lembaga ombudsman dapat membuat keputusan atau rekomendasi terkait kasus tersebut.

Pada tahap klarifikasi, Lembaga Ombudsman DIY biasanya akan menghubungi pihak yang melakukan pengaduan atau keluhan untuk meminta informasi tambahan atau klarifikasi mengenai permasalahan yang dihadapi. Selain itu, lembaga ombudsman juga dapat melakukan wawancara dengan pihak terkait atau melakukan investigasi lebih lanjut untuk memastikan bahwa semua informasi yang diperlukan telah terkumpul dengan baik sebelum membuat keputusan akhir. Dengan melakukan klarifikasi, lembaga ombudsman dapat memastikan bahwa keputusan atau rekomendasi yang diberikan didasarkan oleh informasi yang lengkap dan akurat.

>>